

SCS AQUATERRA

December 4, 2013
File No. 27213733.12

Mr. Ray Pilapil, Manager
Illinois Environmental Protection Agency
Bureau of Air, Compliance Section #40
1021 North Grand Avenue East
Springfield, IL 62702

**Subject: 2013 Annual Open Flare Test Report
Flare Performance Testing
Cottonwood Hills Recycling and Disposal Facility**

Dear Mr. Pilapil:

On behalf of Waste Management of Illinois, Inc., SCS Aquaterra is submitting the attached report of the *Open Flare Annual Test Report* for the Cottonwood Hills Recycling and Disposal Facility in Marissa. Please contact us at (618) 628-2001 with any questions or comments regarding this report.

Sincerely,



Stephanie Settle
Air Services Professional
SCS AQUATERRA

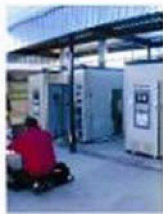
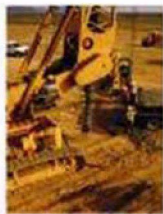


Tim Pool
Associate Professional, Geologist
SCS AQUATERRA

cc Ernest Dennison, P.E. – Waste Management of Illinois, Inc.
Kevin Mattison – IEPA Bureau of Air – Des Plaines Office
John Justice – IEPA Bureau of Air – Collinsville Office

Enclosures





Open Flare Annual Test Report

Cottonwood Hills Recycling and Disposal Facility Marissa, Illinois

Prepared For:

Waste Management of Illinois, Inc.



601 Madison Avenue
East St. Louis, Illinois 62201

Prepared By:

SCS AQUATERRA
13 Executive Drive, Suite 1
Fairview Heights, IL 62208
(618) 628-2001

November 2013
File No. 27213733.12

Offices Nationwide
www.scsengineers.com

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1 INTRODUCTION

SCS Aquaterra was retained by Waste Management of Illinois, Inc. to perform the 2013 annual sampling of the open flare at the Cottonwood Hills Recycling and Disposal Facility (Cottonwood Hills RDF) located in Marissa, Illinois. The flare testing was performed in accordance with the requirements of the Illinois Environmental Protection Agency (IEPA), New Source Performance Standards (NSPS), and Construction Permit No. 06100058. Tim Pool of SCS Aquaterra performed the Cottonwood Hills RDF flare testing on February 7, 2013 and August 8, 2013; and Jacob Allen of SCS Aquaterra performed the testing on September 26, 2013 and October 24, 2013.

2 FIELD ACTIVITIES

The Cottonwood Hills RDF landfill gas collection and control system is routed to an open landfill gas flare. The open flare is used for the destruction of landfill gas and the control of landfill gas emissions. The flare was installed per Construction Permit No. 06100058 and began operations on February 5, 2008. The flare was continually operated with a flame present at all times during the test period.

Four test events were conducted on the open flare. The test events were completed in February, August, September, and October 2013. The visual test of the open flare was conducted during the August 2013 event. Landfill gas samples were collected for laboratory analysis during the February, September, and October test events. Copies of the Cottonwood Hills RDF flare testing field logs are presented in Appendix A. Field testing information including sampling times and flare system performance data are recorded on the field logs.

In accordance with Section 6 of Construction Permit No. 06100058, landfill gas samples were collected for analysis of heat value, nonmethane organic compounds (NMOCs), and fixed gas. Six samples were collected in stainless steel canisters (Summa canister) for analysis of select parameters. Samples CWH-4, CWH-5, and CWH-6 were collected on February 7, 2013 and samples CW-4, CW-5, and CW-6 were collected on September 26, 2013. The landfill gas samples were collected under vacuum at the Cottonwood Hills RDF flare inlet using Summa canisters. A calibrated flow control regulator was used to regulate the flow of the landfill gas at the approximate flow rate of 100 milliliters per minute into each evacuated Summa canister. The landfill gas sample canisters were delivered to ALS Environmental (ALS), previously referred to as Columbia Analytical Services (CAS), in Simi Valley, California for laboratory analysis of net heating value, NMOCs and fixed gas analysis per ASTM D3588-98, EPA Method 25C and Method 3C, respectively. Copies of the laboratory reports are presented in Appendix B.

Six additional samples were collected during the monitoring events for analysis of sulfur compounds. Samples CWH-1, CWH-2, and CWH-3 were collected on February 7, 2013; and samples CWH-7, CWH-8, and CWH-9 were collected on October 24, 2013. These landfill gas samples were collected using 1.0 Liter Zefon bags at the sample port located on the Milam RDF flare inlet. The landfill gas samples were delivered to ALS for analysis of sulfur compounds per ASTM D5504-08. Copies of the laboratory reports are presented in Appendix B.

3 ANALYSIS AND RESULTS

The Cottonwood Hills RDF flare testing was performed in accordance with Construction Permit No. 06100058, NSPS, and the relevant guidelines for test methods provided at 40 CFR Part 60, Appendix A. A discussion of the results is provided in the following sections.

3.1 VISIBLE EMISSIONS

Visible emissions (opacity) testing of the Cottonwood Hills RDF flare was performed by personnel with SCS Aquaterra on August 8, 2013 in accordance with EPA Method 22, *Determination of Fugitive Emissions from Material Sources and Smoke Emissions from Flares*. The visual emissions from the enclosed flare were continuously monitored for a 2-hour timeframe and documented at 5-minute intervals. A 5-minute rest period occurred after each 20-minute observation period. The Method 22 test results for the Cottonwood Hills RDF flare are summarized on the Method 22 Testing Field Log presented in Appendix A. The results of the visible emissions test indicated no detectable visible emissions from the Cottonwood Hills RDF flare; therefore, the flare was operated within the maximum permitted emission limit. A summary of the Cottonwood Hills RDF flare visible emissions testing results is presented as follows.

Actual Visible Emission Event per 2 hours	Allowable Visible Emission Event per 2 hours
0 seconds	5 minutes

3.2 FUEL HEATING VALUE

Six of the landfill gas samples collected during the February 2013 and September 2013 events were analyzed for net heating value by ASTM Method D3588-98 and fixed gases per EPA Method 3C. The results of the laboratory analyses are provided in Appendix B. The laboratory analysis indicated that the net heating value of the landfill gas at the time of sample collection was in compliance with the minimum requirements as described in 40 CFR 60.18(c)(3)(ii). The

net heating value of the landfill gas collected during the test event was also calculated based on the concentration of methane in the landfill gas, in accordance with 40 CFR 60.18(f)(3) and 40 CFR 60.754(e). Per 40 CFR 60.754(e), the net heating value of combusted landfill gas is calculated from the concentration of methane in the landfill gas as measured by EPA Method 3C. The measurement of other organic components, hydrogen, and carbon monoxide is not applicable. The results of the net heating value calculation comply with the requirements of 40 CFR 60.18(c)(3)(ii) and not surprisingly are slightly less than the laboratory measured values. This is due to the fact that the calculation considers the heating value of only the methane portion of the landfill gas, while the laboratory analysis considers the heating value of all components of the landfill gas contributing to the net heating value, including methane and other organic compounds. Detailed calculations are provided in Appendix C. A summary of the laboratory results, calculated heating values, and allowable heating value for the Cottonwood Hills RDF flare are presented in the following table.

Date	Run No.	Laboratory Analytical Heating Value (MJ/scm)	Calculated Heating Value (MJ/scm)	Minimum Allowable Heating Value (MJ/scm)
2/7/13	CWH-4	16.4	15.9	7.45
2/7/13	CWH-5	16.1	15.6	7.45
2/7/13	CWH-6	16.3	15.8	7.45
9/26/13	CW4	18.4	17.8	7.45
9/26/13	CW5	18.5	17.9	7.45
9/26/13	CW6	18.5	17.9	7.45

MJ/scm: Mega joule per standard cubic meter

3.3 FIXED GAS ANALYSIS

Per the requirements of Construction Permit No. 06100058, landfill gas samples collected during the February 2013 and September 2013 events were analyzed for fixed gases, including methane and carbon monoxide, by EPA Method 3C. The results of the analysis, reported as percent volume (%), are provided in the following table.

Date Collected	2/7/2013			9/26/2013			Average
Parameter	CWH-4	CWH-5	CWH-6	CW4	CW5	CW6	
Hydrogen	0.6%	0.6%	0.6%	0.8%	0.8%	0.8%	0.7%
Oxygen	2.8%	3.1%	2.9%	1.2%	1.1%	1.0%	2.0%
Nitrogen	14.6%	15.5%	14.8%	7.5%	7.2%	6.9%	11.1%
Carbon Monoxide	ND	ND	ND	ND	ND	ND	ND
Methane	47.6%	46.8%	47.4%	53.4%	53.6%	53.8%	50.4%
Carbon Dioxide	34.3%	33.8%	34.2%	37.0%	37.1%	37.3%	35.6%

ND: Not detected at or above the reporting limit

3.4 NMOC ANALYSIS

Per the requirements of Construction Permit No. 06100058, landfill gas samples collected during the February 2013 and September 2013 events were analyzed for NMOCs by EPA Method 25C. The laboratory results, reported as NMOC (as methane), were converted to NMOC (as hexane), to be consistent with the units reported under NSPS. To convert to the proper units, each NMOC (as methane) result was divided by six. The results of the NMOC (as methane) and calculated NMOC (as hexane) in the samples are summarized in the following table.

Date	Run No.	NMOC (as methane) (ppmv)	NMOC (as hexane) (ppmv)
2/7/13	CWH-4	4,200	700
2/7/13	CWH-5	4,300	717
2/7/13	CWH-6	4,500	750
9/26/13	CW4	3,900	650
9/26/13	CW5	3,800	633
9/26/13	CW6	4,200	700

ppmv: parts per million by volume

3.5 TOTAL SULFUR COMPOUNDS

A total of six landfill gas samples collected during the February 2013 and October 2013 event were analyzed for twenty sulfur compounds, including hydrogen sulfide, by ASTM Method D5504-08. The results of the laboratory analyses are provided in Appendix B. The average sulfur content for the samples collected was 398.6 ppmv. A summary of the sulfur compounds tested for and their concentrations is provided on the following table.

Date Collected		2/7/13			10/24/2013		
Parameter	Units	CWH-1	CWH-2	CWH-3	CWH-7	CWH-8	CWH-9
Hydrogen Sulfide	ppbv	430,000	430,000	440,000	270,000	380,000	330,000
Carbonyl Sulfide	ppbv	1,400	1,400	1,300	1,100	1,300	1,100
Methyl Mercaptan	ppbv	6,700	6,900	6,700	4,500	6,200	5,500
Ethyl Mercaptan	ppbv	200	210	190	ND	ND	ND
Dimethyl Sulfide	ppbv	7,500	7,500	7,300	6,300	7,800	7,000
Carbon Disulfide	ppbv	550	530	530	680	770	740
Isopropyl Mercaptan	ppbv	1,800	1,700	1,700	1,100	1,500	1,400
tert-Butyl Mercaptan	ppbv	300	290	320	230	510	690
n-Propyl Mercaptan	ppbv	ND	ND	ND	ND	ND	ND

Date Collected		2/7/13			10/24/2013		
Parameter	Units	CWH-1	CWH-2	CWH-3	CWH-7	CWH-8	CWH-9
Ethyl Methyl Sulfide	ppbv	ND	ND	ND	ND	ND	ND
Thiophene	ppbv	1,600	1,800	1,800	820	1,000	1,100
Isobutyl Mercaptan	ppbv	ND	ND	ND	ND	ND	ND
Diethyl Sulfide	ppbv	ND	ND	ND	ND	ND	ND
n-Butyl Mercaptan	ppbv	ND	ND	ND	ND	ND	ND
Dimethyl Disulfide	ppbv	ND	ND	53	ND	ND	ND
3-Methylthiophene	ppbv	ND	ND	ND	ND	ND	ND
Tetrahydrothiophene	ppbv	ND	ND	ND	ND	ND	ND
2,5-Dimethylthiophene	ppbv	ND	ND	ND	ND	ND	ND
2-Ethylthiophene	ppbv	ND	ND	ND	ND	ND	ND
Diethyl Disulfide	ppbv	ND	ND	ND	ND	ND	ND
Total Per Sample (ppbV)	ppbv	450,050	450,330	459,893	284,730	399,080	347,530
Average in ppmV	ppmv	398.6					

ppbv: parts per billion by volume

ppmv: parts per million by volume

ND: Not detected at or above the reporting limit

4 GENERAL COMMENTS

This report is based on available information as provided to SCS Aquaterra. This report has been prepared for the exclusive use of Waste Management of Illinois, Inc. for specific application to the project discussed and has been prepared in accordance with generally accepted engineering practices. No warranties, express or implied, are intended or made. In the event that changes in the nature, design, or location of the project as outlined in this report are planned or implemented, this report shall not be considered valid unless the changes are reviewed and this report modified or verified in writing by the engineer.

APPENDIX A
FIELD LOGS

SCS AQUATERRA

LANDFILL GAS FLARE TESTING LOG

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Sampler Tim Pool

Date 2/7/2013
Sample I.D. CWH-1
Bag I.D. 90675-56782
Bag Vol. 1.0 liter

Temperature Measurements

Flare Temp.* 1468 Deg. F
Gas Temp.** 98 Deg. F

* Measured with CAT 123-6700 Infrared Thermometer II with Laser Sighting

** Measured with in-line thermometer

Pressure Measurement

Static Pressure* 4.00 Inches H₂O

* Measured with Shortridge Instruments, Inc. Airdata Multimeter ADM 860 #M00577

Flow Rate Record

Time 1441
Flow Rate* 946 SCFM

*Recorded from continuous flowmeter

SCS AQUATERRA

LANDFILL GAS FLARE TESTING LOG

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Sampler Tim Pool

Date 2/7/2013

Sample I.D. CWH-2

Bag I.D. 90675-56778

Bag Vol. 1.0 liter

Temperature Measurements

Flare Temp.* 1472 Deg. F

Gas Temp.** 98 Deg. F

* Measured with CAT 123-6700 Infrared Thermometer II with Laser Sighting

** Measured with in-line thermometer

Pressure Measurement

Static Pressure* 4 Inches H₂O

* Measured with Shortridge Instruments, Inc. Airdata Multimeter ADM 860 #M00577

Flow Rate Record

Time 1446

Flow Rate* 949 SCFM

*Recorded from continuous flowmeter

SCS AQUATERRA
LANDFILL GAS FLARE TESTING LOG

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Sampler Tim Pool

Date 2/7/2013

Sample I.D. CWH-3

Bag I.D. 90675-56777

Bag Vol. 1.0 liter

Temperature Measurements

Flare Temp.* 1473 Deg. F

Gas Temp.** 98 Deg. F

* Measured with CAT 123-6700 Infrared Thermometer II with Laser Sighting

** Measured with in-line thermometer

Pressure Measurement

Static Pressure* 4 Inches H₂O

* Measured with Shortridge Instruments, Inc. Airdata Multimeter ADM 860 #M00577

Flow Rate Record

Time 1451

Flow Rate* 946 SCFM

*Recorded from continuous flowmeter

SCS AQUATERRA

LANDFILL GAS FLARE TESTING LOG

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Sampler Tim Pool

Date 2/7/2013

Sample I.D. CWH-4

Canister I.D. 1SC00965 Flow Control ID AVG02208

Canister Vol. 1.0 liter

Temperature Measurements

Flare Temp.* 1462 Deg. F

Gas Temp.** 98 Deg. F

* Recorded from flare chart recorder

** Measured with in-line thermometer

Pressure Measurement

Static Pressure* 4 Inches H₂O

* Measured with Inline Gauge

Flow Rate Record

Time 1453

Flow Rate* 948 SCFM

*Recorded from continuous flowmeter

Summa Canister Vacuum Readings

Initial Vacuum -29 Inches Hg

Final Vacuum -2 Inches Hg

Start Time 1453

End Time 1503

SCS AQUATERRA
LANDFILL GAS FLARE TESTING LOG

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Sampler Tim Pool

Date 2/7/2013

Sample I.D. CWH-5

Canister I.D. 1SC01036 Flow Control ID AVG01459

Canister Vol. 1.0 liter

Temperature Measurements

Flare Temp.* 1466 Deg. F

Gas Temp.** 98 Deg. F

* Recorded from flare chart recorder

** Measured with in-line thermometer

Pressure Measurement

Static Pressure* 4 Inches H₂O

* Measured with Inline Gauge

Flow Rate Record

Time 1506

Flow Rate* 949 SCFM

*Recorded from continuous flowmeter

Summa Canister Vacuum Readings

Initial Vacuum -27 Inches Hg

Final Vacuum -3 Inches Hg

Start Time 1506

End Time 1516

SCS AQUATERRA

LANDFILL GAS FLARE TESTING LOG

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Sampler Tim Pool

Date 2/7/2013

Sample I.D. CWH-6

Canister I.D. 1SC00397 Flow Control ID AVG02837

Canister Vol. 1.0 liter

Temperature Measurements

Flare Temp.* 1469 Deg. F

Gas Temp.** 98 Deg. F

* Recorded from flare chart recorder

** Measured with in-line thermometer

Pressure Measurement

Static Pressure* 4 Inches H₂O

* Measured with Inline gauge

Flow Rate Record

Time 1520

Flow Rate* 947 SCFM

*Recorded from continuous flowmeter

Summa Canister Vacuum Readings

Initial Vacuum -29 Inches Hg

Final Vacuum -2 Inches Hg

Start Time 1520

End Time 1530

SCS AQUATERRA

LANDFILL GAS FLARE TESTING LOG

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Sampler Jacob Allen

Date 9/26/2013

Sample I.D. CW-4

Canister I.D. 1SC01160 Flow Control ID AVG00813

Canister Vol. 1.0 liter

Temperature Measurements

Flare Temp.* 1372 Deg. F

Gas Temp.** 127 Deg. F

* Recorded from flare chart recorder

** Measured with in-line thermometer

Pressure Measurement

Static Pressure* Not Functional Inches H₂O

* Measured with Inline Gauge

Flow Rate Record

Time 1500

Flow Rate* 975 SCFM

*Recorded from continuous flowmeter

Summa Canister Vacuum Readings

Initial Vacuum -29 Inches Hg

Final Vacuum -2 Inches Hg

Start Time 1504

End Time 1522

SCS AQUATERRA

LANDFILL GAS FLARE TESTING LOG

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Sampler Jacob Allen

Date 9/26/2013

Sample I.D. CW-5

Canister I.D. 1SC01023 Flow Control ID AVG01142

Canister Vol. 1.0 liter

Temperature Measurements

Flare Temp.* 1462 Deg. F

Gas Temp.** 128 Deg. F

* Recorded from flare chart recorder

** Measured with in-line thermometer

Pressure Measurement

Static Pressure* Not Functional Inches H₂O

* Measured with Inline Gauge

Flow Rate Record

Time 1522

Flow Rate* 971 SCFM

*Recorded from continuous flowmeter

Summa Canister Vacuum Readings

Initial Vacuum -25 Inches Hg

Final Vacuum -2 Inches Hg

Start Time 1523

End Time 1534

SCS AQUATERRA

LANDFILL GAS FLARE TESTING LOG

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Sampler Jacob Allen

Date 9/26/2013

Sample I.D. CW-6

Canister I.D. 1SC00392 Flow Control ID AVG01673

Canister Vol. 1.0 liter

Temperature Measurements

Flare Temp.* 1467 Deg. F

Gas Temp.** 128 Deg. F

* Recorded from flare chart recorder

** Measured with in-line thermometer

Pressure Measurement

Static Pressure* Not Functional Inches H₂O

* Measured with Inline gauge

Flow Rate Record

Time 1535

Flow Rate* 974 SCFM

*Recorded from continuous flowmeter

Summa Canister Vacuum Readings

Initial Vacuum -30 Inches Hg

Final Vacuum -2 Inches Hg

Start Time 1536

End Time 1551

SCS AQUATERRA

LANDFILL GAS FLARE TESTING LOG

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Sampler Jacob Allen

Date 10/24/2013

Sample I.D. CWH-7

Bag I.D. 90675-60677

Bag Vol. 1.0 liter

Temperature Measurements

Flare Temp.* 1120 Deg. F

Gas Temp.** 101 Deg. F

* Measured with CAT 123-6700 Infrared Thermometer II with Laser Sighting

** Measured with in-line thermometer

Pressure Measurement

Static Pressure* 0.40 Inches H₂O

* Measured with Shortridge Instruments, Inc. Airdata Multimeter ADM 860 #M00577

Flow Rate Record

Time 1435

Flow Rate* 896 SCFM

*Recorded from continuous flowmeter

SCS AQUATERRA

LANDFILL GAS FLARE TESTING LOG

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Sampler Jacob Allen

Date 10/24/2013

Sample I.D. CWH-8

Bag I.D. 90675-60675

Bag Vol. 1.0 liter

Temperature Measurements

Flare Temp.* 1116 Deg. F

Gas Temp.** 101 Deg. F

* Measured with CAT 123-6700 Infrared Thermometer II with Laser Sighting

** Measured with in-line thermometer

Pressure Measurement

Static Pressure* 0.4 Inches H₂O

* Measured with Shortridge Instruments, Inc. Airdata Multimeter ADM 860 #M00577

Flow Rate Record

Time 1445

Flow Rate* 894 SCFM

*Recorded from continuous flowmeter

SCS AQUATERRA

LANDFILL GAS FLARE TESTING LOG

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Sampler Jacob Allen

Date 10/24/2013

Sample I.D. CWH-9

Bag I.D. 90675-60676

Bag Vol. 1.0 liter

Temperature Measurements

Flare Temp.* 1125 Deg. F

Gas Temp.** 101 Deg. F

* Measured with CAT 123-6700 Infrared Thermometer II with Laser Sighting

** Measured with in-line thermometer

Pressure Measurement

Static Pressure* 0.4 Inches H₂O

* Measured with Shortridge Instruments, Inc. Airdata Multimeter ADM 860 #M00577

Flow Rate Record

Time 1455

Flow Rate* 892 SCFM

*Recorded from continuous flowmeter

AQUATERRA ENVIRONMENTAL SOLUTIONS, INC.

LANDFILL GAS FLARE TESTING LOG

VISIBLE EMISSIONS INSPECTION - METHOD 22

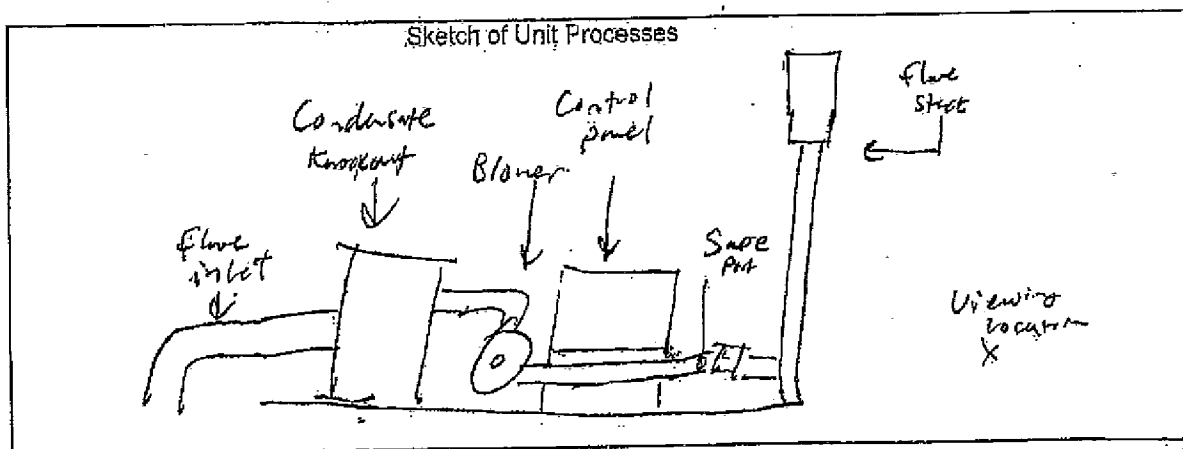
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Tester Tim Pool

Date 8/8/2013

Time (Hour:Min.)	Elapsed Time (Minutes)	Accumulate Emissions (Min.:Sec.)	Time (Hour:Min.)	Elapsed Time (Minutes)	Accumulate Emissions (Min.:Sec.)
10:00	0		11:15	60	
10:05	5	0:00	11:20	65	0:00
10:10	10	0:00	11:25	70	0:00
10:15	15	0:00	11:30	75	0:00
10:20	20	0:00	11:35	80	0:00
10:25	20		11:40	80	
10:30	25	0:00	11:45	85	0:00
10:35	30	0:00	11:50	90	0:00
10:40	35	0:00	11:55	95	0:00
10:45	40	0:00	12:00	100	0:00
10:50	40		12:05	100	
10:55	45	0:00	12:10	105	0:00
11:00	50	0:00	12:15	110	0:00
11:05	55	0:00	12:20	115	0:00
11:10	60	0:00	12:25	120	0:00
First Hour Subtotal:		0:0	Second Hour Subtotal:		0:00
Total Visible Emissions:				0:00	

Notes:



WM00721

APPENDIX B
LABORATORY REPORTS

Heating Value, Fixed Gases, and NMOC Analysis

LABORATORY REPORT

February 25, 2013

Tim Pool
Aquaterra Environmental Solutions, Inc.
13 Executive Dr., Suite 1
Fairview Heights, IL 62208

RE: Cottonwood Hills Flare Gas Sample / 4733.12

Dear Tim:

Enclosed are the results of the samples submitted to our laboratory on February 12, 2013. For your reference, these analyses have been assigned our service request number P1300562.

All analyses were performed according to our laboratory's NELAP and DoD-ELAP-approved quality assurance program. The test results meet requirements of the current NELAP and DoD-ELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP and DoD-ELAP-accredited analytes, refer to the certifications section at www.caslab.com. Results are intended to be considered in their entirety and apply only to the samples analyzed and reported herein.

Columbia Analytical Services, Inc. dba ALS Environmental (ALS) is certified by the NELAP Laboratory Certificate No. 02115CA; Arizona Department of Health Services, Certificate No. AZ0694; Florida Department of Health, NELAP Certification E871020; New Jersey Department of Environmental Protection, NELAP Laboratory Certification ID #CA009; New York State Department of Health, NELAP NY Lab ID No: 11221; Oregon Environmental Laboratory Accreditation Program, NELAP ID: CA200007; The American Industrial Hygiene Association, Laboratory #101661; United States Department of Defense Environmental Laboratory Accreditation Program (DoD-ELAP), Certificate No. L11-203; Pennsylvania Registration No. 68-03307; TX Commission of Environmental Quality, NELAP ID T104704413-12-3; Minnesota Department of Health, NELAP Certificate No. 494864; Washington State Department of Ecology, ELAP Lab ID: C946, State of Utah Department of Health, NELAP Certificate No. CA015272012-2; State of Maine Laboratory Certification Program, Certificate No. 2012039. Each of the certifications listed above have an explicit Scope of Accreditation that applies to specific matrices/methods/analytes; therefore, please contact me for information corresponding to a particular certification.

If you have any questions, please call me at (805) 526-7161.

Respectfully submitted,

ALS | Environmental



By Sue Anderson at 11:06 am, Feb 25, 2013

Sue Anderson
Project Manager

Client: Aquaterra Environmental Solutions, Inc. Service Request No: P1300562
Project: Cottonwood Hills Flare Gas Sample / 4733.12

CASE NARRATIVE

The samples were received intact under chain of custody on February 12, 2013 and were stored in accordance with the analytical method requirements. Please refer to the sample acceptance check form for additional information. The results reported herein are applicable only to the condition of the samples at the time of sample receipt.

BTU and CHONS Analysis

The results for BTU and CHONS were generated according to ASTM D 3588-98. The following analyses were performed and used to calculate the BTU and CHONS results.

C2 through C6 Hydrocarbon Analysis

The samples were analyzed according to modified EPA Method TO-3 for C₂ through >C₆ hydrocarbons using a gas chromatograph equipped with a flame ionization detector (FID).

Fixed Gases Analysis

The samples were also analyzed for fixed gases (hydrogen, oxygen/argon, nitrogen, carbon monoxide, methane and carbon dioxide) according to ASTM D 1946 using a gas chromatograph equipped with a thermal conductivity detector (TCD).

Hydrogen Sulfide Analysis

The samples were also analyzed for hydrogen sulfide per ASTM D 5504-08 using a gas chromatograph equipped with a sulfur chemiluminescence detector (SCD).

Total Gaseous Non-Methane Organics as Methane Analysis

The samples were also analyzed for total gaseous non-methane organics as methane according to modified EPA Method 25C. The analyses included a single sample injection (method modification) analyzed by gas chromatography using flame ionization detection/total combustion analysis.

The results of analyses are given in the attached laboratory report. All results are intended to be considered in their entirety, and Columbia Analytical Services, Inc. dba ALS Environmental (ALS) is not responsible for utilization of less than the complete report.

Use of Columbia Analytical Services, Inc. dba ALS Environmental (ALS)'s Name. Client shall not use ALS's name or trademark in any marketing or reporting materials, press releases or in any other manner ("Materials") whatsoever and shall not attribute to ALS any test result, tolerance or specification derived from ALS's data ("Attribution") without ALS's prior written consent, which may be withheld by ALS for any reason in its sole discretion. To request ALS's consent, Client shall provide copies of the proposed Materials or Attribution and describe in writing Client's proposed use of such Materials or Attribution. If ALS has not provided written approval of the Materials or Attribution within ten (10) days of receipt from Client, Client's request to use ALS's name or trademark in any Materials or Attribution shall be deemed denied. ALS may, in its discretion, reasonably charge Client for its time in reviewing Materials or Attribution requests. Client acknowledges and agrees that the unauthorized use of ALS's name or trademark may cause ALS to incur irreparable harm for which the recovery of money damages will be inadequate. Accordingly, Client acknowledges and agrees that a violation shall justify preliminary injunctive relief. For questions contact the laboratory.

DETAIL SUMMARY REPORT

Client: Aquaterra Environmental Solutions, Inc.
Project ID: Cottonwood Hills Flare Gas Sample / 4733.12

Service Request: P1300562

Date Received: 2/12/2013
Time Received: 09:20

Client Sample ID	Lab Code	Matrix	Date Collected	Time Collected	Container ID	Pi1 (psig)	Pfi (psig)				
								TO-3 Modified - C1C6+ Can	3C Modified - Fxd Gases Can	ASTM D5504-01 - H2S Can	25C Modified - TGNMO+ 1X Can
CWH-4	P1300562-001	Air	2/7/2013	14:53	ISC00965	-1.11	8.54	X	X	X	X
CWH-5	P1300562-002	Air	2/7/2013	15:06	ISC01036	-1.51	6.05	X	X	X	X
CWH-6	P1300562-003	Air	2/7/2013	15:20	ISC00397	-1.08	6.98	X	X	X	X

2655 Park Center Drive, Suite A
Simi Valley, California 93065
Phone (805) 526-7161
Fax (805) 526-7270

Requested Turnaround Time in Business Days (Surcharges) please circle 1 Day (100%) 2 Day (75%) 3 Day (50%) 4 Day (35%) 5 Day (25%) 10 Day-Standard	CAS Project No. P1300562
---	------------------------------------

Company Name & Address (Reporting Information) Aquaterra Environmental Solutions Inc. 13 Executive Drive suite 1 Fairview Heights, IL 62208		Project Name Cottonwood Hills Flare Gas Sample		CAS Contact:	
Project Manager Tim Paul		Project Number 4733.12		Analysis Method	
Phone (618) 628-2001		P.O. # / Billing Information		ASTM D3588 Heating Valve VMOC EPA 25C Other EPA 3C/10-3	
Fax (618) 628-2002		Sampler (Print & Sign) Jacob Allen			
Email Address for Result Reporting +pool@aquaterra-env.com		Comments e.g. Actual Preservative or specific instructions			

Client Sample ID	Laboratory ID Number	Date Collected	Time Collected	Canister ID (Bar code # - AC, SC, etc.)	Flow Controller ID (Bar code # - FC #)	Canister Start Pressure "Hg	Canister End Pressure "Hg/psig	Sample Volume			
CWH-4	①-148	2-7-13	1453	1SC00965	AVG02208	-29	-2				
CWH-5	②-178	2-7-13	1506	1SC01036	AVG01451	-27	-3				
4 of 16 CWH-6	③-146	2-7-13	1520	1SC00397	AVG02837	-29	-2				

Report Tier Levels - please select Tier I - Results (Default if not specified) _____ Tier II (Results + QC Summaries) _____		Tier III (Results + QC & Calibration Summaries) _____ Tier IV (Data Validation Package) 10% Surcharge _____		EDD required Yes / No Type: _____		Project Requirements (MRLs, QAPP)
Relinquished by: (Signature) Jacob Allen		Date: 2-7-13	Time: 1600	Received by: (Signature) [Signature]		
Relinquished by: (Signature)		Date:	Time:	Received by: (Signature)		Cooler / Blank Temperature _____ °C

WM00727

Sample Acceptance Check Form

Client: Aquaterra Environmental Solutions, Inc. Work order: P1300562
Project: Cottonwood Hills Flare Gas Sample / 4733.12
Sample(s) received on: 2/12/13 Date opened: 2/12/13 by: MZAMORA

Note: This form is used for all samples received by ALS. The use of this form for custody seals is strictly meant to indicate presence/absence and not as an indication of compliance or nonconformity. Thermal preservation and pH will only be evaluated either at the request of the client and/or as required by the method/SOP.

	Yes	No	N/A
1 Were sample containers properly marked with client sample ID?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2 Container(s) supplied by ALS ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3 Did sample containers arrive in good condition?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4 Were chain-of-custody papers used and filled out?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5 Did sample container labels and/or tags agree with custody papers?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6 Was sample volume received adequate for analysis?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7 Are samples within specified holding times?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8 Was proper temperature (thermal preservation) of cooler at receipt adhered to?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
9 Was a trip blank received?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
10 Were custody seals on outside of cooler/Box?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Location of seal(s)? _____ Sealing Lid?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were signature and date included?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were seals intact?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were custody seals on outside of sample container?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Location of seal(s)? _____ Sealing Lid?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were signature and date included?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were seals intact?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
11 Do containers have appropriate preservation , according to method/SOP or Client specified information?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Is there a client indication that the submitted samples are pH preserved?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were VOA vials checked for presence/absence of air bubbles?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Does the client/method/SOP require that the analyst check the sample pH and <u>if necessary</u> alter it?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
12 Tubes: Are the tubes capped and intact?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Do they contain moisture?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
13 Badges: Are the badges properly capped and intact?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Are dual bed badges separated and individually capped and intact?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Lab Sample ID	Container Description	Required pH *	Received pH	Adjusted pH	VOA Headspace (Presence/Absence)	Receipt / Preservation Comments
P1300562-001.01	1.0 L Source Can					
P1300562-002.01	1.0 L Source Can					
P1300562-003.01	1.0 L Source Can					

Explain any discrepancies: (include lab sample ID numbers): _____

RSK - MEEPP, HCL (pH<2); RSK - CO2, (pH 5-8); Sulfur (pH>4)

RESULTS OF ANALYSIS

Page 1 of 1

Client: Aquaterra Environmental Solutions, Inc.
Client Sample ID: CWH-4
Client Project ID: Cottonwood Hills Flare Gas Sample / 4733.12

CAS Project ID: P1300562
CAS Sample ID: P1300562-001

Test Code: ASTM D3588-98
Analyst: Mike Conejo/Wade Henton/Jennifer Young
Sample Type: 1.0 L Summa Canister
Test Notes:

Date Collected: 2/7/13
Date Received: 2/12/13

Initial Pressure (psig): -1.11 Final Pressure (psig): 8.54

Canister Dilution Factor: 1.71

Components	Result Volume %	Result Weight %	Data Qualifier
Hydrogen	0.64	0.05	
Oxygen + Argon	2.83	3.26	
Nitrogen	14.56	14.65	
Carbon Monoxide	< 0.01	< 0.01	
Methane	47.58	27.43	
Carbon Dioxide	34.27	54.21	
Hydrogen Sulfide	< 0.01	< 0.01	
Ethane	< 0.01	< 0.01	
Propane	< 0.01	0.01	
Butanes	< 0.01	0.01	
Pentanes	0.01	0.03	
Hexanes	0.01	0.04	
> Hexanes	0.07	0.30	
TOTALS	99.99	99.99	

Components	Mole %	Weight %
Carbon	21.75	35.62
Hydrogen	50.99	7.01
Oxygen + Argon	19.57	42.70
Nitrogen	7.68	14.67
Sulfur	< 0.10	< 0.10

Specific Gravity (Air = 1)		0.9607
Specific Volume	ft ³ /lb	13.64
Gross Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/ft ³	489.9
Net Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/ft ³	441.1
Gross Heating Value (Water Saturated at 0.25636 psia)	BTU/ft ³	480.1
Net Heating Value (Water Saturated at 0.25636 psia)	BTU/ft ³	432.3
Gross Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/lb	6,681.0
Net Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/lb	6,016.1
Compressibility Factor "Z" (60 F, 14.696 psia)		0.9974

RESULTS OF ANALYSIS

Page 1 of 1

Client: Aquaterra Environmental Solutions, Inc.
Client Sample ID: CWH-5
Client Project ID: Cottonwood Hills Flare Gas Sample / 4733.12

CAS Project ID: P1300562
CAS Sample ID: P1300562-002

Test Code: ASTM D3588-98
Analyst: Mike Conejo/Wade Henton/Jennifer Young
Sample Type: 1.0 L Summa Canister
Test Notes:

Date Collected: 2/7/13
Date Received: 2/12/13

Initial Pressure (psig): -1.51 Final Pressure (psig): 6.05

Canister Dilution Factor: 1.57

Components	Result Volume %	Result Weight %	Data Qualifier
Hydrogen	0.63	0.05	
Oxygen + Argon	3.12	3.59	
Nitrogen	15.55	15.65	
Carbon Monoxide	< 0.01	< 0.01	
Methane	46.83	26.99	
Carbon Dioxide	33.77	53.41	
Hydrogen Sulfide	< 0.01	< 0.01	
Ethane	< 0.01	< 0.01	
Propane	< 0.01	0.01	
Butanes	< 0.01	0.01	
Pentanes	0.01	0.04	
Hexanes	0.01	0.04	
> Hexanes	0.05	0.19	
TOTALS	99.99	99.99	

Components	Mole %	Weight %
Carbon	21.56	34.99
Hydrogen	50.53	6.88
Oxygen + Argon	19.63	42.45
Nitrogen	8.28	15.67
Sulfur	< 0.10	< 0.10

Specific Gravity (Air = 1)		0.9607
Specific Volume	ft ³ /lb	13.64
Gross Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/ft ³	480.7
Net Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/ft ³	432.8
Gross Heating Value (Water Saturated at 0.25636 psia)	BTU/ft ³	471.2
Net Heating Value (Water Saturated at 0.25636 psia)	BTU/ft ³	424.2
Gross Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/lb	6,556.3
Net Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/lb	5,903.3
Compressibility Factor "Z" (60 F, 14.696 psia)		0.9975

RESULTS OF ANALYSIS

Page 1 of 1

Client: Aquaterra Environmental Solutions, Inc.
Client Sample ID: CWH-6
Client Project ID: Cottonwood Hills Flare Gas Sample / 4733.12

CAS Project ID: P1300562
CAS Sample ID: P1300562-003

Test Code: ASTM D3588-98
Analyst: Mike Conejo/Wade Henton/Jennifer Young
Sample Type: 1.0 L Summa Canister
Test Notes:

Date Collected: 2/7/13
Date Received: 2/12/13

Initial Pressure (psig): -1.08 **Final Pressure (psig):** 6.98

Canister Dilution Factor: 1.59

Components	Result Volume %	Result Weight %	Data Qualifier
Hydrogen	0.62	0.05	
Oxygen + Argon	2.90	3.34	
Nitrogen	14.77	14.87	
Carbon Monoxide	< 0.01	< 0.01	
Methane	47.38	27.31	
Carbon Dioxide	34.22	54.11	
Hydrogen Sulfide	< 0.01	< 0.01	
Ethane	< 0.01	< 0.01	
Propane	< 0.01	0.01	
Butanes	< 0.01	0.01	
Pentanes	0.01	0.04	
Hexanes	0.01	0.04	
> Hexanes	0.05	0.22	
TOTALS	99.99	99.99	

Components	Mole %	Weight %
Carbon	21.71	35.45
Hydrogen	50.85	6.97
Oxygen + Argon	19.63	42.71
Nitrogen	7.81	14.88
Sulfur	< 0.10	< 0.10

Specific Gravity (Air = 1)		0.9609
Specific Volume	ft ³ /lb	13.64
Gross Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/ft ³	486.9
Net Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/ft ³	438.4
Gross Heating Value (Water Saturated at 0.25636 psia)	BTU/ft ³	477.2
Net Heating Value (Water Saturated at 0.25636 psia)	BTU/ft ³	429.7
Gross Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/lb	6,638.7
Net Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/lb	5,977.7
Compressibility Factor "Z" (60 F, 14.696 psia)		0.9974

RESULTS OF ANALYSIS

Page 1 of 1

Client: Aquaterra Environmental Solutions, Inc.
Client Sample ID: CWH-4
Client Project ID: Cottonwood Hills Flare Gas Sample / 4733.12

CAS Project ID: P1300562
 CAS Sample ID: P1300562-001

Test Code: EPA Method 3C Modified
Instrument ID: HP5890 II/GC1/TCD
Analyst: Jennifer Young
Sample Type: 1.0 L Summa Canister
Test Notes:

Date Collected: 2/7/13
Date Received: 2/12/13
Date Analyzed: 2/13/13
Volume(s) Analyzed: 0.10 ml(s)

Initial Pressure (psig): -1.11 Final Pressure (psig): 8.54

Canister Dilution Factor: 1.71

CAS #	Compound	Result %, v/v	MRL %, v/v	Data Qualifier
1333-74-0	Hydrogen	0.637	0.17	
7782-44-7	Oxygen +			
7440-37-1	Argon	2.83	0.17	
7727-37-9	Nitrogen	14.6	0.17	
630-08-0	Carbon Monoxide	ND	0.17	
74-82-8	Methane	47.6	0.17	
124-38-9	Carbon Dioxide	34.3	0.17	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

RESULTS OF ANALYSIS

Page 1 of 1

Client: Aquaterra Environmental Solutions, Inc.
Client Sample ID: CWH-5
Client Project ID: Cottonwood Hills Flare Gas Sample / 4733.12

CAS Project ID: P1300562
CAS Sample ID: P1300562-002

Test Code: EPA Method 3C Modified
Instrument ID: HP5890 II/GC1/TCD
Analyst: Jennifer Young
Sample Type: 1.0 L Summa Canister
Test Notes:

Date Collected: 2/7/13
Date Received: 2/12/13
Date Analyzed: 2/13/13
Volume(s) Analyzed: 0.10 ml(s)

Initial Pressure (psig): -1.51 Final Pressure (psig): 6.05

Canister Dilution Factor: 1.57

CAS #	Compound	Result %, v/v	MRL %, v/v	Data Qualifier
1333-74-0	Hydrogen	0.630	0.16	
7782-44-7	Oxygen +			
7440-37-1	Argon	3.12	0.16	
7727-37-9	Nitrogen	15.6	0.16	
630-08-0	Carbon Monoxide	ND	0.16	
74-82-8	Methane	46.8	0.16	
124-38-9	Carbon Dioxide	33.8	0.16	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

RESULTS OF ANALYSIS

Page 1 of 1

Client: Aquaterra Environmental Solutions, Inc.
Client Sample ID: CWH-6
Client Project ID: Cottonwood Hills Flare Gas Sample / 4733.12

CAS Project ID: P1300562
CAS Sample ID: P1300562-003

Test Code: EPA Method 3C Modified
Instrument ID: HP5890 II/GC1/TCD
Analyst: Jennifer Young
Sample Type: 1.0 L Summa Canister
Test Notes:

Date Collected: 2/7/13
Date Received: 2/12/13
Date Analyzed: 2/13/13
Volume(s) Analyzed: 0.10 ml(s)

Initial Pressure (psig): -1.08 Final Pressure (psig): 6.98

Canister Dilution Factor: 1.59

CAS #	Compound	Result %, v/v	MRL %, v/v	Data Qualifier
1333-74-0	Hydrogen	0.625	0.16	
7782-44-7	Oxygen +			
7440-37-1	Argon	2.90	0.16	
7727-37-9	Nitrogen	14.8	0.16	
630-08-0	Carbon Monoxide	ND	0.16	
74-82-8	Methane	47.4	0.16	
124-38-9	Carbon Dioxide	34.2	0.16	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

RESULTS OF ANALYSIS

Page 1 of 1

Client: Aquaterra Environmental Solutions, Inc.
Client Sample ID: Method Blank
Client Project ID: Cottonwood Hills Flare Gas Sample / 4733.12

CAS Project ID: P1300562
 CAS Sample ID: P130213-MB

Test Code: EPA Method 3C Modified
Instrument ID: HP5890 II/GC1/TCD
Analyst: Jennifer Young
Sample Type: 1.0 L Summa Canister
Test Notes:

Date Collected: NA
Date Received: NA
Date Analyzed: 2/13/13
Volume(s) Analyzed: 0.10 ml(s)

CAS #	Compound	Result %, v/v	MRL %, v/v	Data Qualifier
1333-74-0	Hydrogen	ND	0.10	
7782-44-7	Oxygen +			
7440-37-1	Argon	ND	0.10	
7727-37-9	Nitrogen	ND	0.10	
630-08-0	Carbon Monoxide	ND	0.10	
74-82-8	Methane	ND	0.10	
124-38-9	Carbon Dioxide	ND	0.10	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

LABORATORY CONTROL SAMPLE SUMMARY

Page 1 of 1

Client: Aquaterra Environmental Solutions, Inc.
Client Sample ID: Lab Control Sample
Client Project ID: Cottonwood Hills Flare Gas Sample / 4733.12

CAS Project ID: P1300562
 CAS Sample ID: P130213-LCS

Test Code: EPA Method 3C Modified
Instrument ID: HP5890 II/GC1/TCD
Analyst: Jennifer Young
Sample Type: 1.0 L Summa Canister
Test Notes:

Date Collected: NA
Date Received: NA
Date Analyzed: 2/13/13
Volume(s) Analyzed: NA ml(s)

CAS #	Compound	Spike Amount ppmV	Result ppmV	% Recovery	CAS Acceptance Limits	Data Qualifier
1333-74-0	Hydrogen	40,000	35,400	89	75-117	
7782-44-7	Oxygen +					
7440-37-1	Argon	50,000	47,900	96	85-111	
7727-37-9	Nitrogen	50,000	48,700	97	85-114	
630-08-0	Carbon Monoxide	50,000	47,800	96	85-119	
74-82-8	Methane	40,000	37,400	94	90-114	
124-38-9	Carbon Dioxide	50,000	46,300	93	84-113	

RESULTS OF ANALYSIS

Page 1 of 1

Client: Aquaterra Environmental Solutions, Inc.
Client Project ID: Cottonwood Hills Flare Gas Sample / 4733.12

CAS Project ID: P1300562

Total Gaseous Nonmethane Organics (TGNMO) as Methane

Test Code: EPA Method 25C Modified
Instrument ID: HP5890 II/GC1/FID/TCA
Analyst: Wade Henton
Sampling Media: 1.0 L Summa Canister(s)
Test Notes:

Date(s) Collected: 2/7/13
Date Received: 2/12/13
Date Analyzed: 2/13/13

Client Sample ID	CAS Sample ID	Canister Dilution Factor	Injection Volume ml(s)	Result ppmV	MRL ppmV	Data Qualifier
CWH-4	P1300562-001	1.71	0.50	4,200	1.7	
CWH-5	P1300562-002	1.57	0.50	4,300	1.6	
CWH-6	P1300562-003	1.59	0.50	4,500	1.6	
Method Blank	P130213-MB	1.00	0.50	ND	1.0	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

LABORATORY CONTROL SAMPLE SUMMARY

Page 1 of 1

Client: Aquaterra Environmental Solutions, Inc.
Client Sample ID: Lab Control Sample
Client Project ID: Cottonwood Hills Flare Gas Sample / 4733.12

CAS Project ID: P1300562
 CAS Sample ID: P130213-LCS

Test Code: EPA Method 25C Modified
Instrument ID: HP5890 II/GC1/FID/TCA
Analyst: Wade Henton
Sampling Media: 1.0 L Summa Canister
Test Notes:

Date Collected: NA
 Date Received: NA
 Date Analyzed: 2/13/13
 Volume(s) Analyzed: NA ml(s)

Compound	Spike Amount ppmV	Result ppmV	% Recovery	CAS Acceptance Limits	Data Qualifier
Total Gaseous Nonmethane Organics (TGNMO) as Methane	99.0	108	109	85-139	

LABORATORY DUPLICATE SUMMARY RESULTS

Page 1 of 1

Client: Aquaterra Environmental Solutions, Inc.
Client Sample ID: CWH-4
Client Project ID: Cottonwood Hills Flare Gas Sample / 4733.12

CAS Project ID: P1300562
 CAS Sample ID: P1300562-001DUP

Test Code: EPA Method 25C Modified
Instrument ID: HP5890 II/GC1/FID/TCA
Analyst: Wade Henton
Sampling Media: 1.0 L Summa Canister
Test Notes:
Container ID: 1SC00965

Date Collected: 2/7/13
Date Received: 2/12/13
Date Analyzed: 2/13/13
Volume(s) Analyzed: 0.50 ml(s)

Initial Pressure (psig): -1.11 Final Pressure (psig): 8.54

Canister Dilution Factor: 1.71

Compound	Sample Result ppmV	Duplicate Sample Result ppmV	Average	% RPD	RPD Limit	Data Qualifier
Total Gaseous Nonmethane Organics (TGNMO) as Methane	4,170	3,980	4075	5	14	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.



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LABORATORY REPORT

October 15, 2013

Tim Pool
SCS Aquaterra
13 Executive Dr., Suite 1
Fairview Heights, IL 62208

RE: CWH Flare Gas Sample / 27213733.12

Dear Tim:

Enclosed are the results of the samples submitted to our laboratory on October 1, 2013. For your reference, these analyses have been assigned our service request number P1304361.

All analyses were performed according to our laboratory's NELAP and DoD-ELAP-approved quality assurance program. The test results meet requirements of the current NELAP and DoD-ELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP and DoD-ELAP-accredited analytes, refer to the certifications section at www.alsglobal.com. Results are intended to be considered in their entirety and apply only to the samples analyzed and reported herein.

If you have any questions, please call me at (805) 526-7161.

Respectfully submitted,

ALS | Environmental

By Sue Anderson at 9:20 am, Oct 15, 2013

Sue Anderson
Project Manager

RIGHT SOLUTIONS | RIGHT PARTNER



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T: +1 805 526 7161
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www.alsglobal.com

Client: SCS Aquaterra
Project: CWH Flare Gas Sample / 27213733.12

Service Request No: P1304361

CASE NARRATIVE

The samples were received intact under chain of custody on October 1, 2013 and were stored in accordance with the analytical method requirements. Please refer to the sample acceptance check form for additional information. The results reported herein are applicable only to the condition of the samples at the time of sample receipt.

BTU and CHONS Analysis

The results for BTU and CHONS were generated according to ASTM D 3588-98. The following analyses were performed and used to calculate the BTU and CHONS results. This method is not included on the laboratory's NELAP, DoD-ELAP, or AIHA-LAP scope of accreditation.

C2 through C6 Hydrocarbon Analysis

The samples were analyzed according to modified EPA Method TO-3 for C2 through >C6 hydrocarbons using a gas chromatograph equipped with a flame ionization detector (FID). This method is not included on the laboratory's NELAP or AIHA-LAP scope of accreditation.

Fixed Gases Analysis

The samples were also analyzed for fixed gases (hydrogen, oxygen/argon, nitrogen, carbon monoxide, methane and carbon dioxide) according to modified EPA Method 3C (single injection) using a gas chromatograph equipped with a thermal conductivity detector (TCD). This method is not included on the laboratory's NELAP or AIHA-LAP scope of accreditation.

Hydrogen Sulfide Analysis

The samples were also analyzed for hydrogen sulfide per ASTM D 5504-08 using a gas chromatograph equipped with a sulfur chemiluminescence detector (SCD). This method is not included on the laboratory's NELAP, DoD-ELAP, or AIHA-LAP scope of accreditation.

Total Gaseous Non-Methane Organics as Methane Analysis

The samples were also analyzed for total gaseous non-methane organics as methane according to modified EPA Method 25C. The analyses included a single sample injection (method modification) analyzed by gas chromatography using flame ionization detection/total combustion analysis.

The results of analyses are given in the attached laboratory report. All results are intended to be considered in their entirety, and ALS Environmental (ALS) is not responsible for utilization of less than the complete report.

Use of ALS Environmental (ALS)'s Name. Client shall not use ALS's name or trademark in any marketing or reporting materials, press releases or in any other manner ("Materials") whatsoever and shall not attribute to ALS any test result, tolerance or specification derived from ALS's data ("Attribution") without ALS's prior written consent, which may be withheld by ALS for any reason in its sole discretion. To request ALS's consent, Client shall provide copies of the proposed Materials or Attribution and describe in writing Client's proposed use of such Materials or Attribution. If ALS has not provided written approval of the Materials or Attribution within ten (10) days of receipt from Client, Client's request to use ALS's name or trademark in any Materials or Attribution shall be deemed denied. ALS may, in its discretion, reasonably charge Client for its time in reviewing Materials or Attribution requests. Client acknowledges and agrees that the unauthorized use of ALS's name or trademark may cause ALS to incur irreparable harm for which the recovery of money damages will be inadequate. Accordingly, Client acknowledges and agrees that a violation shall justify preliminary injunctive relief. For questions contact the laboratory.

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ALS Environmental – Simi Valley

Certifications, Accreditations, and Registrations

Agency	Web Site	Number
AIHA	http://www.aihaaccreditedlabs.org	101661
Arizona DHS	http://www.azdhs.gov/lab/license/env.htm	AZ0694
DoD ELAP	http://www.pjilabs.com/search-accredited-labs	L11-203
Florida DOH (NELAP)	http://www.doh.state.fl.us/lab/EnvLabCert/WaterCert.htm	E871020
Maine DHHS	http://www.maine.gov/dhhs/mecdc/environmental-health/water/dwp-services/labcert/labcert.htm	2012039
Minnesota DOH (NELAP)	http://www.health.state.mn.us/accreditation	581572
New Jersey DEP (NELAP)	http://www.nj.gov/dep/oqa/	CA009
New York DOH (NELAP)	http://www.wadsworth.org/labcert/elap/elap.html	11221
Oregon PHD (NELAP)	http://public.health.oregon.gov/LaboratoryServices/EnvironmentalLaboratoryAccreditation/Pages/index.aspx	CA200007
Pennsylvania DEP	http://www.depweb.state.pa.us/labs	68-03307 (Registration)
Texas CEQ (NELAP)	http://www.tceq.texas.gov/field/qa/env_lab_accreditation.html	T104704413-13-4
Utah DOH (NELAP)	http://www.health.utah.gov/lab/labimp/certification/index.html	CA016272013-3
Washington DOE	http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html	C946

Analyses were performed according to our laboratory's NELAP and DoD-ELAP approved quality assurance program. A complete listing of specific NELAP and DoD-ELAP certified analytes can be found in the certifications section at www.alsglobal.com, or at the accreditation body's website.

Each of the certifications listed above have an explicit Scope of Accreditation that applies to specific matrices/methods/analytes; therefore, please contact the laboratory for information corresponding to a particular certification.

ALS ENVIRONMENTAL

DETAIL SUMMARY REPORT

Client: SCS Aquaterra
Project ID: CWH Flare Gas Sample / 27213733.12

Service Request: P1304361

Date Received: 10/1/2013
Time Received: 09:00

Client Sample ID	Lab Code	Matrix	Date Collected	Time Collected	Container ID	Pi1 (psig)	Pfi (psig)				
								TO-3 Modified - C1C6+ Can	3C Modified - Fxd Gases Can	ASTM D5504-01 - H2S Can	25C Modified - TGNMO+ 1X Can
CW4	P1304361-001	Air	9/26/2013	15:04	ISC01160	-1.18	7.27	X	X	X	X
CW5	P1304361-002	Air	9/26/2013	15:23	ISC01023	-2.25	5.26	X	X	X	X
CW6	P1304361-003	Air	9/26/2013	15:36	ISC00392	-1.04	6.54	X	X	X	X



Page _____ of _____

Simi Valley, California 93065 Phone (805) 526-7161 Fax (805) 526-7270		Requested Turnaround Time in Business Days (Surcharges) please circle 1 Day (100%) 2 Day (75%) 3 Day (50%) 4 Day (35%) 5 Day (25%) 10 Day-Standard				CAS Project No. P1304361					
Company Name & Address (Reporting Information) Aquaterra Environmental Solutions Inc. 13 Executive Drive Suite 1 Fairview Heights, IL 62208		Project Name CW17 - Flare Gas Sample		Project Number 27213733.12		CAS Contact:		Analysis Method ASTM D3588 Heating Valve UNOC EPA 25C Other EPA 3C/10-3		Comments e.g. Actual Preservative or specific instructions	
Project Manager Tim Paul		P.O. # / Billing Information		Sampler (Print & Sign) Jacob Allen <i>[Signature]</i>							
Phone (618) 628-2001		Fax (618) 628-2002									
Email Address for Result Reporting + paul@aquaterra-env.com											
Client Sample ID	Laboratory ID Number	Date Collected	Time Collected	Canister ID (Bar code # - AC, SC, etc.)	Flow Controller ID (Bar code # - FC #)	Canister Start Pressure "Hg	Canister End Pressure "Hg/psig	Sample Volume			
CW4	①-0.88	9-26-13	1504	1SL01160	AVG00813	-29	-2		X	X	
CW5	②-1.92	9-26-13	1523	1SL01023	AVG01142	-25	-2		X	X	
CW6	③-0.82	9-26-13	1536	1SL00392	AVG01673	-30	-2		X	X	
Report Tier Levels - please select											
Tier I - Results (Default if not specified) _____				Tier III (Results + QC & Calibration Summaries) _____				Tier IV (Data Validation Package) 10% Surcharge _____			
Tier II (Results + QC Summaries) _____				Tier IV (Data Validation Package) 10% Surcharge _____				Tier IV (Data Validation Package) 10% Surcharge _____			
Relinquished by: (Signature) <i>[Signature]</i>				Date: 9-26-13 Time: 1700		Received by: (Signature) <i>[Signature]</i>		Date: 10/1/13 Time: 0900		Project Requirements (MRLs, QAPP)	
Relinquished by: (Signature)				Date: Time:		Received by: (Signature)		Date: Time:		Cooler / Blank Temperature _____ °C	

WM00744

ALS Environmental Sample Acceptance Check Form

Client: SCS Aquaterra

Work order: P1304361

Project: CWH Flare Gas Sample / 27213733.12

Sample(s) received on: 10/1/13

Date opened: 10/1/13

by: RMARTENIES

Note: This form is used for all samples received by ALS. The use of this form for custody seals is strictly meant to indicate presence/absence and not as an indication of compliance or nonconformity. Thermal preservation and pH will only be evaluated either at the request of the client and/or as required by the method/SOP.

	Yes	No	N/A
1 Were sample containers properly marked with client sample ID?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2 Container(s) supplied by ALS ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3 Did sample containers arrive in good condition?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4 Were chain-of-custody papers used and filled out?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5 Did sample container labels and/or tags agree with custody papers?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6 Was sample volume received adequate for analysis?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7 Are samples within specified holding times?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8 Was proper temperature (thermal preservation) of cooler at receipt adhered to?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
9 Was a trip blank received?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
10 Were custody seals on outside of cooler/Box?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Location of seal(s)? _____ Sealing Lid?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were signature and date included?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were seals intact?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were custody seals on outside of sample container?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Location of seal(s)? _____ Sealing Lid?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were signature and date included?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were seals intact?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
11 Do containers have appropriate preservation , according to method/SOP or Client specified information?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Is there a client indication that the submitted samples are pH preserved?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were VOA vials checked for presence/absence of air bubbles?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Does the client/method/SOP require that the analyst check the sample pH and <u>if necessary</u> alter it?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
12 Tubes: Are the tubes capped and intact?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Do they contain moisture?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
13 Badges: Are the badges properly capped and intact?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Are dual bed badges separated and individually capped and intact?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Lab Sample ID	Container Description	Required pH *	Received pH	Adjusted pH	VOA Headspace (Presence/Absence)	Receipt / Preservation Comments
P1304361-001.01	1.0 L Source Can					
P1304361-002.01	1.0 L Source Can					
P1304361-003.01	1.0 L Source Can					

Explain any discrepancies: (include lab sample ID numbers): _____

RSK - MEEPP, HCL (pH<2); RSK - CO2, (pH 5-8); Sulfur (pH>4)

ALS ENVIRONMENTAL

RESULTS OF ANALYSIS

Page 1 of 1

Client: SCS Aquaterra
Client Sample ID: CW4
Client Project ID: CWH Flare Gas Sample / 27213733.12

ALS Project ID: P1304361
 ALS Sample ID: P1304361-001

Test Code: ASTM D3588-98
 Analyst: Mike Conejo/Jennifer Young
 Sample Type: 1.0 L Summa Canister
 Test Notes:
 Container ID: 1SC01160

Date Collected: 9/26/13
 Date Received: 10/1/13

Initial Pressure (psig): -1.18 Final Pressure (psig): 7.27

Canister Dilution Factor: 1.63

Components	Result Volume %	Result Weight %	Data Qualifier
Hydrogen	0.82	0.06	
Oxygen + Argon	1.22	1.42	
Nitrogen	7.47	7.64	
Carbon Monoxide	< 0.01	< 0.01	
Methane	53.42	31.25	
Carbon Dioxide	36.96	59.32	
Hydrogen Sulfide	< 0.01	< 0.01	
C2 as Ethane	< 0.01	< 0.01	
C3 as Propane	< 0.01	0.01	
C4 as n-Butane	< 0.01	0.01	
C5 as n-Pentane	0.01	0.04	
C6 as n-Hexane	0.01	0.04	
> C6 as n-Hexane	0.04	0.18	
TOTALS	99.99	99.99	

Components	Mole %	Weight %
Carbon	22.77	39.79
Hydrogen	54.33	7.97
Oxygen + Argon	19.15	44.59
Nitrogen	3.75	7.64
Sulfur	< 0.10	< 0.10

Specific Gravity (Air = 1)		0.9467
Specific Volume	ft3/lb	13.84
Gross Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/ft3	548.2
Net Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/ft3	493.5
Gross Heating Value (Water Saturated at 0.25636 psia)	BTU/ft3	537.1
Net Heating Value (Water Saturated at 0.25636 psia)	BTU/ft3	483.5
Gross Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/lb	7,587.2
Net Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/lb	6,831.0
Compressibility Factor "Z" (60 F, 14.696 psia)		0.9971

ALS ENVIRONMENTAL

RESULTS OF ANALYSIS

Page 1 of 1

Client: SCS Aquaterra
Client Sample ID: CW5
Client Project ID: CWH Flare Gas Sample / 27213733.12

ALS Project ID: P1304361
 ALS Sample ID: P1304361-002

Test Code: ASTM D3588-98
 Analyst: Mike Conejo/Jennifer Young
 Sample Type: 1.0 L Summa Canister
 Test Notes:
 Container ID: 1SC01023

Date Collected: 9/26/13
 Date Received: 10/1/13

Initial Pressure (psig): -2.25 Final Pressure (psig): 5.26

Canister Dilution Factor: 1.60

Components	Result Volume %	Result Weight %	Data Qualifier
Hydrogen	0.83	0.06	
Oxygen + Argon	1.14	1.33	
Nitrogen	7.22	7.38	
Carbon Monoxide	< 0.01	< 0.01	
Methane	53.58	31.34	
Carbon Dioxide	37.12	59.57	
Hydrogen Sulfide	< 0.01	< 0.01	
C2 as Ethane	< 0.01	< 0.01	
C3 as Propane	< 0.01	0.01	
C4 as n-Butane	< 0.01	0.01	
C5 as n-Pentane	0.02	0.04	
C6 as n-Hexane	0.02	0.05	
> C6 as n-Hexane	0.05	0.19	
TOTALS	99.99	99.99	

Components	Mole %	Weight %
Carbon	22.81	39.94
Hydrogen	54.41	7.99
Oxygen + Argon	19.16	44.67
Nitrogen	3.62	7.38
Sulfur	< 0.10	< 0.10

Specific Gravity (Air = 1)		0.9469
Specific Volume	ft3/lb	13.84
Gross Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/ft3	550.1
Net Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/ft3	495.3
Gross Heating Value (Water Saturated at 0.25636 psia)	BTU/ft3	538.9
Net Heating Value (Water Saturated at 0.25636 psia)	BTU/ft3	485.2
Gross Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/lb	7,612.2
Net Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/lb	6,853.6
Compressibility Factor "Z" (60 F, 14.696 psia)		0.9971

ALS ENVIRONMENTAL

RESULTS OF ANALYSIS

Page 1 of 1

Client: SCS Aquaterra
Client Sample ID: CW6
Client Project ID: CWH Flare Gas Sample / 27213733.12

ALS Project ID: P1304361
ALS Sample ID: P1304361-003

Test Code: ASTM D3588-98
Analyst: Mike Conejo/Jennifer Young
Sample Type: 1.0 L Summa Canister
Test Notes:
Container ID: 1SC00392

Date Collected: 9/26/13
Date Received: 10/1/13

Initial Pressure (psig): -1.04 Final Pressure (psig): 6.54

Canister Dilution Factor: 1.55

Components	Result Volume %	Result Weight %	Data Qualifier
Hydrogen	0.84	0.06	
Oxygen + Argon	1.03	1.21	
Nitrogen	6.92	7.06	
Carbon Monoxide	< 0.01	< 0.01	
Methane	53.81	31.48	
Carbon Dioxide	37.30	59.87	
Hydrogen Sulfide	< 0.01	< 0.01	
C2 as Ethane	< 0.01	< 0.01	
C3 as Propane	< 0.01	0.01	
C4 as n-Butane	< 0.01	0.01	
C5 as n-Pentane	0.02	0.04	
C6 as n-Hexane	0.02	0.05	
> C6 as n-Hexane	0.05	0.20	
TOTALS	99.99	99.99	

Components	Mole %	Weight %
Carbon	22.87	40.13
Hydrogen	54.53	8.03
Oxygen + Argon	19.15	44.77
Nitrogen	3.46	7.07
Sulfur	< 0.10	< 0.10

Specific Gravity (Air = 1)		0.9467
Specific Volume	ft3/lb	13.84
Gross Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/ft3	552.5
Net Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/ft3	497.5
Gross Heating Value (Water Saturated at 0.25636 psia)	BTU/ft3	541.3
Net Heating Value (Water Saturated at 0.25636 psia)	BTU/ft3	487.4
Gross Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/lb	7,647.1
Net Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/lb	6,885.0
Compressibility Factor "Z" (60 F, 14.696 psia)		0.9971

ALS ENVIRONMENTAL

RESULTS OF ANALYSIS

Page 1 of 1

Client: SCS Aquaterra
Client Sample ID: CW4
Client Project ID: CWH Flare Gas Sample / 27213733.12

ALS Project ID: P1304361
 ALS Sample ID: P1304361-001

Test Code: EPA Method 3C Modified
 Instrument ID: HP5890 II/GC1/TCD
 Analyst: Jennifer Young
 Sample Type: 1.0 L Summa Canister
 Test Notes:
 Container ID: 1SC01160

Date Collected: 9/26/13
 Date Received: 10/1/13
 Date Analyzed: 10/4/13
 Volume(s) Analyzed: 0.10 ml(s)

Initial Pressure (psig): -1.18 Final Pressure (psig): 7.27

Canister Dilution Factor: 1.63

CAS #	Compound	Result %, v/v	MRL %, v/v	Data Qualifier
1333-74-0	Hydrogen	0.824	0.16	
7782-44-7	Oxygen +			
7440-37-1	Argon	1.22	0.16	
7727-37-9	Nitrogen	7.48	0.16	
630-08-0	Carbon Monoxide	ND	0.16	
74-82-8	Methane	53.4	0.16	
124-38-9	Carbon Dioxide	37.0	0.16	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

ALS ENVIRONMENTAL

RESULTS OF ANALYSIS

Page 1 of 1

Client: SCS Aquaterra
Client Sample ID: CW5
Client Project ID: CWH Flare Gas Sample / 27213733.12

ALS Project ID: P1304361
 ALS Sample ID: P1304361-002

Test Code: EPA Method 3C Modified
 Instrument ID: HP5890 II/GC1/TCD
 Analyst: Jennifer Young
 Sample Type: 1.0 L Summa Canister
 Test Notes:
 Container ID: 1SC01023

Date Collected: 9/26/13
 Date Received: 10/1/13
 Date Analyzed: 10/4/13
 Volume(s) Analyzed: 0.10 ml(s)

Initial Pressure (psig): -2.25 Final Pressure (psig): 5.26

Canister Dilution Factor: 1.60

CAS #	Compound	Result %, v/v	MRL %, v/v	Data Qualifier
1333-74-0	Hydrogen	0.828	0.16	
7782-44-7	Oxygen +			
7440-37-1	Argon	1.14	0.16	
7727-37-9	Nitrogen	7.22	0.16	
630-08-0	Carbon Monoxide	ND	0.16	
74-82-8	Methane	53.6	0.16	
124-38-9	Carbon Dioxide	37.1	0.16	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

ALS ENVIRONMENTAL

RESULTS OF ANALYSIS

Page 1 of 1

Client: SCS Aquaterra
Client Sample ID: CW6
Client Project ID: CWH Flare Gas Sample / 27213733.12

ALS Project ID: P1304361
 ALS Sample ID: P1304361-003

Test Code: EPA Method 3C Modified
 Instrument ID: HP5890 II/GC1/TCD
 Analyst: Jennifer Young
 Sample Type: 1.0 L Summa Canister
 Test Notes:
 Container ID: 1SC00392

Date Collected: 9/26/13
 Date Received: 10/1/13
 Date Analyzed: 10/4/13
 Volume(s) Analyzed: 0.10 ml(s)

Initial Pressure (psig): -1.04 Final Pressure (psig): 6.54

Canister Dilution Factor: 1.55

CAS #	Compound	Result %, v/v	MRL %, v/v	Data Qualifier
1333-74-0	Hydrogen	0.844	0.16	
7782-44-7	Oxygen +			
7440-37-1	Argon	1.03	0.16	
7727-37-9	Nitrogen	6.92	0.16	
630-08-0	Carbon Monoxide	ND	0.16	
74-82-8	Methane	53.8	0.16	
124-38-9	Carbon Dioxide	37.3	0.16	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

ALS ENVIRONMENTAL

RESULTS OF ANALYSIS

Page 1 of 1

Client: SCS Aquaterra
Client Sample ID: Method Blank
Client Project ID: CWH Flare Gas Sample / 27213733.12

ALS Project ID: P1304361
 ALS Sample ID: P131004-MB

Test Code: EPA Method 3C Modified
 Instrument ID: HP5890 II/GC1/TCD
 Analyst: Jennifer Young
 Sample Type: 1.0 L Summa Canister
 Test Notes:

Date Collected: NA
 Date Received: NA
 Date Analyzed: 10/04/13
 Volume(s) Analyzed: 0.10 ml(s)

CAS #	Compound	Result %, v/v	MRL %, v/v	Data Qualifier
1333-74-0	Hydrogen	ND	0.10	
7782-44-7	Oxygen +			
7440-37-1	Argon	ND	0.10	
7727-37-9	Nitrogen	ND	0.10	
630-08-0	Carbon Monoxide	ND	0.10	
74-82-8	Methane	ND	0.10	
124-38-9	Carbon Dioxide	ND	0.10	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

ALS ENVIRONMENTAL

LABORATORY CONTROL SAMPLE SUMMARY

Page 1 of 1

Client: SCS Aquaterra
Client Sample ID: Lab Control Sample
Client Project ID: CWH Flare Gas Sample / 27213733.12

ALS Project ID: P1304361
ALS Sample ID: P131004-LCS

Test Code: EPA Method 3C Modified
Instrument ID: HP5890 II/GC1/TCD
Analyst: Jennifer Young
Sample Type: 1.0 L Summa Canister
Test Notes:

Date Collected: NA
Date Received: NA
Date Analyzed: 10/04/13
Volume(s) Analyzed: NA ml(s)

CAS #	Compound	Spike Amount ppmV	Result ppmV	% Recovery	ALS	Data Qualifier
					Acceptance Limits	
1333-74-0	Hydrogen	40,000	39,600	99	84-110	
7782-44-7	Oxygen +					
7440-37-1	Argon	50,000	52,600	105	88-114	
7727-37-9	Nitrogen	50,000	53,000	106	88-114	
630-08-0	Carbon Monoxide	50,000	52,100	104	88-113	
74-82-8	Methane	40,000	40,500	101	87-110	
124-38-9	Carbon Dioxide	50,000	50,400	101	84-109	

ALS ENVIRONMENTAL

RESULTS OF ANALYSIS

Page 1 of 1

Client: SCS Aquaterra
Client Project ID: CWH Flare Gas Sample / 27213733.12

ALS Project ID: P1304361

Total Gaseous Nonmethane Organics (TGNMO) as Methane

Test Code: EPA Method 25C Modified
Instrument ID: HP5890 II/GC1/FID/TCA
Analyst: Jennifer Young
Sampling Media: 1.0 L Summa Canister(s)
Test Notes:

Date(s) Collected: 9/26/13
Date Received: 10/1/13
Date Analyzed: 10/4/13

Client Sample ID	ALS Sample ID	Canister Dilution Factor	Injection Volume ml(s)	Result ppmV	MRL ppmV	Data Qualifier
CW4	P1304361-001	1.63	0.50	3,900	1.6	
CW5	P1304361-002	1.60	0.50	3,800	1.6	
CW6	P1304361-003	1.55	0.50	4,200	1.6	
Method Blank	P131004-MB	1.00	0.50	ND	1.0	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

ALS ENVIRONMENTAL

LABORATORY CONTROL SAMPLE SUMMARY

Page 1 of 1

Client: SCS Aquaterra
Client Sample ID: Lab Control Sample
Client Project ID: CWH Flare Gas Sample / 27213733.12

ALS Project ID: P1304361
ALS Sample ID: P131004-LCS

Test Code: EPA Method 25C Modified
Instrument ID: HP5890 II/GC1/FID/TCA
Analyst: Jennifer Young
Sampling Media: 1.0 L Summa Canister
Test Notes:

Date Collected: NA
Date Received: NA
Date Analyzed: 10/04/13
Volume(s) Analyzed: NA ml(s)

Compound	Spike Amount ppmV	Result ppmV	% Recovery	ALS	Data Qualifier
				Acceptance Limits	
Total Gaseous Nonmethane Organics (TGNMO) as Methane	99.0	101	102	85-139	

Sulfur Compounds Analysis

LABORATORY REPORT

February 13, 2013

Tim Pool
Aquaterra Environmental Solutions, Inc.
13 Executive Dr., Suite 1
Fairview Heights, IL 62208

RE: Cottonwood Hills Flare Gas Sample / 4733.12

Dear Tim:

Enclosed are the results of the samples submitted to our laboratory on February 8, 2013. For your reference, these analyses have been assigned our service request number P1300527.

All analyses were performed according to our laboratory's NELAP and DoD-ELAP-approved quality assurance program. The test results meet requirements of the current NELAP and DoD-ELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP and DoD-ELAP-accredited analytes, refer to the certifications section at www.caslab.com. Results are intended to be considered in their entirety and apply only to the samples analyzed and reported herein.

Columbia Analytical Services, Inc. dba ALS Environmental (ALS) is certified by the NELAP Laboratory Certificate No. 02115CA; Arizona Department of Health Services, Certificate No. AZ0694; Florida Department of Health, NELAP Certification E871020; New Jersey Department of Environmental Protection, NELAP Laboratory Certification ID #CA009; New York State Department of Health, NELAP NY Lab ID No: 11221; Oregon Environmental Laboratory Accreditation Program, NELAP ID: CA200007; The American Industrial Hygiene Association, Laboratory #101661; United States Department of Defense Environmental Laboratory Accreditation Program (DoD-ELAP), Certificate No. L11-203; Pennsylvania Registration No. 68-03307; TX Commission of Environmental Quality, NELAP ID T104704413-12-3; Minnesota Department of Health, NELAP Certificate No. 494864; Washington State Department of Ecology, ELAP Lab ID: C946, State of Utah Department of Health, NELAP Certificate No. CA015272012-2; State of Maine Laboratory Certification Program, Certificate No. 2012039. Each of the certifications listed above have an explicit Scope of Accreditation that applies to specific matrices/methods/analytes; therefore, please contact me for information corresponding to a particular certification.

If you have any questions, please call me at (805) 526-7161.

Respectfully submitted,

ALS | Environmental



By Sue Anderson at 4:54 pm, Feb 13, 2013

Sue Anderson
Project Manager

Client: Aquaterra Environmental Solutions, Inc. Service Request No: P1300527
Project: Cottonwood Hills Flare Gas Sample / 4733.12

CASE NARRATIVE

The samples were received intact under chain of custody on February 8, 2013 and were stored in accordance with the analytical method requirements. Please refer to the sample acceptance check form for additional information. The results reported herein are applicable only to the condition of the samples at the time of sample receipt.

Sulfur Analysis

The samples were analyzed for twenty sulfur compounds per ASTM D 5504-08 using a gas chromatograph equipped with a sulfur chemiluminescence detector (SCD). All compounds with the exception of hydrogen sulfide and carbonyl sulfide are quantitated against the initial calibration curve for methyl mercaptan. This method is not included on the laboratory's NELAP or DoD-ELAP scope of accreditation.

The results of analyses are given in the attached laboratory report. All results are intended to be considered in their entirety, and Columbia Analytical Services, Inc. dba ALS Environmental (ALS) is not responsible for utilization of less than the complete report.

Use of Columbia Analytical Services, Inc. dba ALS Environmental (ALS)'s Name. Client shall not use ALS's name or trademark in any marketing or reporting materials, press releases or in any other manner ("Materials") whatsoever and shall not attribute to ALS any test result, tolerance or specification derived from ALS's data ("Attribution") without ALS's prior written consent, which may be withheld by ALS for any reason in its sole discretion. To request ALS's consent, Client shall provide copies of the proposed Materials or Attribution and describe in writing Client's proposed use of such Materials or Attribution. If ALS has not provided written approval of the Materials or Attribution within ten (10) days of receipt from Client, Client's request to use ALS's name or trademark in any Materials or Attribution shall be deemed denied. ALS may, in its discretion, reasonably charge Client for its time in reviewing Materials or Attribution requests. Client acknowledges and agrees that the unauthorized use of ALS's name or trademark may cause ALS to incur irreparable harm for which the recovery of money damages will be inadequate. Accordingly, Client acknowledges and agrees that a violation shall justify preliminary injunctive relief. For questions contact the laboratory.

DETAIL SUMMARY REPORT

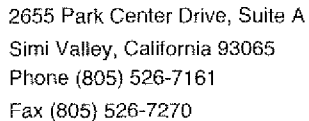
Client: Aquaterra Environmental Solutions, Inc.
Project ID: Cottonwood Hills Flare Gas Sample / 4733.12

Service Request: P1300527

Date Received: 2/8/2013
Time Received: 09:40

ASTM D5504-01 - Sulfur Bag

Client Sample ID	Lab Code	Matrix	Date Collected	Time Collected	
CWH-1	P1300527-001	Air	2/7/2013	14:41	X
CWH-2	P1300527-002	Air	2/7/2013	14:46	X
CWH-3	P1300527-003	Air	2/7/2013	14:51	X



Page _____ of _____

WM00760

Sample Acceptance Check Form

Client: Aquaterra Environmental Solutions, Inc. Work order: P1300527
Project: Cottonwood Hills Flare Gas Sample / 4733.12
Sample(s) received on: 2/8/13 Date opened: 2/8/13 by: MZAMORA

Note: This form is used for all samples received by ALS. The use of this form for custody seals is strictly meant to indicate presence/absence and not as an indication of compliance or nonconformity. Thermal preservation and pH will only be evaluated either at the request of the client and/or as required by the method/SOP.

	Yes	No	N/A
1 Were sample containers properly marked with client sample ID?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2 Container(s) supplied by ALS ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3 Did sample containers arrive in good condition?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4 Were chain-of-custody papers used and filled out?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5 Did sample container labels and/or tags agree with custody papers?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6 Was sample volume received adequate for analysis?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7 Are samples within specified holding times?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8 Was proper temperature (thermal preservation) of cooler at receipt adhered to?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
9 Was a trip blank received?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
10 Were custody seals on outside of cooler/Box?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Location of seal(s)? _____ Sealing Lid?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were signature and date included?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were seals intact?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were custody seals on outside of sample container?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Location of seal(s)? _____ Sealing Lid?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were signature and date included?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were seals intact?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
11 Do containers have appropriate preservation , according to method/SOP or Client specified information?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Is there a client indication that the submitted samples are pH preserved?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were VOA vials checked for presence/absence of air bubbles?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Does the client/method/SOP require that the analyst check the sample pH and <u>if necessary</u> alter it?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
12 Tubes: Are the tubes capped and intact?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Do they contain moisture?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
13 Badges: Are the badges properly capped and intact?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Are dual bed badges separated and individually capped and intact?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Lab Sample ID	Container Description	Required pH *	Received pH	Adjusted pH	VOA Headspace (Presence/Absence)	Receipt / Preservation Comments
P1300527-001.01	1 L Zefon Bag					
P1300527-002.01	1 L Zefon Bag					
P1300527-003.01	1 L Zefon Bag					

Explain any discrepancies: (include lab sample ID numbers): _____

RSK - MEEPP, HCL (pH<2); RSK - CO₂, (pH 5-8); Sulfur (pH>4)

RESULTS OF ANALYSIS

Page 1 of 1

Client: Aquaterra Environmental Solutions, Inc.
Client Sample ID: CWH-1
Client Project ID: Cottonwood Hills Flare Gas Sample / 4733.12

CAS Project ID: P1300527
 CAS Sample ID: P1300527-001

Test Code: ASTM D 5504-08
Instrument ID: Agilent 7890A/GC22/SCD
Analyst: Mike Conejo
Sample Type: 1 L Zefon Bag
Test Notes:

Date Collected: 2/7/13
Time Collected: 14:41
Date Received: 2/8/13
Date Analyzed: 2/8/13
Time Analyzed: 12:19
Volume(s) Analyzed: 0.050 ml(s)

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
7783-06-4	Hydrogen Sulfide	610,000	140	430,000	100	
463-58-1	Carbonyl Sulfide	3,400	250	1,400	100	
74-93-1	Methyl Mercaptan	13,000	200	6,700	100	
75-08-1	Ethyl Mercaptan	510	250	200	100	
75-18-3	Dimethyl Sulfide	19,000	250	7,500	100	
75-15-0	Carbon Disulfide	1,700	160	550	50	
75-33-2	Isopropyl Mercaptan	5,600	310	1,800	100	
75-66-1	tert-Butyl Mercaptan	1,100	370	300	100	
107-03-9	n-Propyl Mercaptan	ND	310	ND	100	
624-89-5	Ethyl Methyl Sulfide	ND	310	ND	100	
110-02-1	Thiophene	5,500	340	1,600	100	
513-44-0	Isobutyl Mercaptan	ND	370	ND	100	
352-93-2	Diethyl Sulfide	ND	370	ND	100	
109-79-5	n-Butyl Mercaptan	ND	370	ND	100	
624-92-0	Dimethyl Disulfide	ND	190	ND	50	
616-44-4	3-Methylthiophene	ND	400	ND	100	
110-01-0	Tetrahydrothiophene	ND	360	ND	100	
638-02-8	2,5-Dimethylthiophene	ND	460	ND	100	
872-55-9	2-Ethylthiophene	ND	460	ND	100	
110-81-6	Diethyl Disulfide	ND	250	ND	50	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

RESULTS OF ANALYSIS

Page 1 of 1

Client: Aquaterra Environmental Solutions, Inc.
Client Sample ID: CWH-2
Client Project ID: Cottonwood Hills Flare Gas Sample / 4733.12

CAS Project ID: P1300527
CAS Sample ID: P1300527-002

Test Code: ASTM D 5504-08
Instrument ID: Agilent 7890A/GC22/SCD
Analyst: Mike Conejo
Sample Type: 1 L Zefon Bag
Test Notes:

Date Collected: 2/7/13
Time Collected: 14:46
Date Received: 2/8/13
Date Analyzed: 2/8/13
Time Analyzed: 12:35
Volume(s) Analyzed: 0.050 ml(s)

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
7783-06-4	Hydrogen Sulfide	600,000	140	430,000	100	
463-58-1	Carbonyl Sulfide	3,300	250	1,400	100	
74-93-1	Methyl Mercaptan	14,000	200	6,900	100	
75-08-1	Ethyl Mercaptan	530	250	210	100	
75-18-3	Dimethyl Sulfide	19,000	250	7,500	100	
75-15-0	Carbon Disulfide	1,600	160	530	50	
75-33-2	Isopropyl Mercaptan	5,200	310	1,700	100	
75-66-1	tert-Butyl Mercaptan	1,100	370	290	100	
107-03-9	n-Propyl Mercaptan	ND	310	ND	100	
624-89-5	Ethyl Methyl Sulfide	ND	310	ND	100	
110-02-1	Thiophene	6,300	340	1,800	100	
513-44-0	Isobutyl Mercaptan	ND	370	ND	100	
352-93-2	Diethyl Sulfide	ND	370	ND	100	
109-79-5	n-Butyl Mercaptan	ND	370	ND	100	
624-92-0	Dimethyl Disulfide	ND	190	ND	50	
616-44-4	3-Methylthiophene	ND	400	ND	100	
110-01-0	Tetrahydrothiophene	ND	360	ND	100	
638-02-8	2,5-Dimethylthiophene	ND	460	ND	100	
872-55-9	2-Ethylthiophene	ND	460	ND	100	
110-81-6	Diethyl Disulfide	ND	250	ND	50	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

RESULTS OF ANALYSIS

Page 1 of 1

Client: Aquaterra Environmental Solutions, Inc.
Client Sample ID: CWH-3
Client Project ID: Cottonwood Hills Flare Gas Sample / 4733.12

CAS Project ID: P1300527
CAS Sample ID: P1300527-003

Test Code: ASTM D 5504-08
Instrument ID: Agilent 7890A/GC22/SCD
Analyst: Mike Conejo
Sample Type: 1 L Zefon Bag
Test Notes:

Date Collected: 2/7/13
Time Collected: 14:51
Date Received: 2/8/13
Date Analyzed: 2/8/13
Time Analyzed: 13:08
Volume(s) Analyzed: 0.050 ml(s)

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
7783-06-4	Hydrogen Sulfide	610,000	140	440,000	100	
463-58-1	Carbonyl Sulfide	3,300	250	1,300	100	
74-93-1	Methyl Mercaptan	13,000	200	6,700	100	
75-08-1	Ethyl Mercaptan	480	250	190	100	
75-18-3	Dimethyl Sulfide	19,000	250	7,300	100	
75-15-0	Carbon Disulfide	1,700	160	530	50	
75-33-2	Isopropyl Mercaptan	5,200	310	1,700	100	
75-66-1	tert-Butyl Mercaptan	1,200	370	320	100	
107-03-9	n-Propyl Mercaptan	ND	310	ND	100	
624-89-5	Ethyl Methyl Sulfide	ND	310	ND	100	
110-02-1	Thiophene	6,100	340	1,800	100	
513-44-0	Isobutyl Mercaptan	ND	370	ND	100	
352-93-2	Diethyl Sulfide	ND	370	ND	100	
109-79-5	n-Butyl Mercaptan	ND	370	ND	100	
624-92-0	Dimethyl Disulfide	210	190	53	50	
616-44-4	3-Methylthiophene	ND	400	ND	100	
110-01-0	Tetrahydrothiophene	ND	360	ND	100	
638-02-8	2,5-Dimethylthiophene	ND	460	ND	100	
872-55-9	2-Ethylthiophene	ND	460	ND	100	
110-81-6	Diethyl Disulfide	ND	250	ND	50	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

RESULTS OF ANALYSIS

Page 1 of 1

Client: Aquaterra Environmental Solutions, Inc.
Client Sample ID: Method Blank
Client Project ID: Cottonwood Hills Flare Gas Sample / 4733.12

CAS Project ID: P1300527
CAS Sample ID: P130208-MB

Test Code: ASTM D 5504-08
Instrument ID: Agilent 7890A/GC22/SCD
Analyst: Mike Conejo
Sample Type: 1 L Zefon Bag
Test Notes:

Date Collected: NA
Time Collected: NA
Date Received: NA
Date Analyzed: 2/08/13
Time Analyzed: 08:05
Volume(s) Analyzed: 1.0 ml(s)

CAS #	Compound	Result $\mu\text{g}/\text{m}^3$	MRL $\mu\text{g}/\text{m}^3$	Result ppbV	MRL ppbV	Data Qualifier
7783-06-4	Hydrogen Sulfide	ND	7.0	ND	5.0	
463-58-1	Carbonyl Sulfide	ND	12	ND	5.0	
74-93-1	Methyl Mercaptan	ND	9.8	ND	5.0	
75-08-1	Ethyl Mercaptan	ND	13	ND	5.0	
75-18-3	Dimethyl Sulfide	ND	13	ND	5.0	
75-15-0	Carbon Disulfide	ND	7.8	ND	2.5	
75-33-2	Isopropyl Mercaptan	ND	16	ND	5.0	
75-66-1	tert-Butyl Mercaptan	ND	18	ND	5.0	
107-03-9	n-Propyl Mercaptan	ND	16	ND	5.0	
624-89-5	Ethyl Methyl Sulfide	ND	16	ND	5.0	
110-02-1	Thiophene	ND	17	ND	5.0	
513-44-0	Isobutyl Mercaptan	ND	18	ND	5.0	
352-93-2	Diethyl Sulfide	ND	18	ND	5.0	
109-79-5	n-Butyl Mercaptan	ND	18	ND	5.0	
624-92-0	Dimethyl Disulfide	ND	9.6	ND	2.5	
616-44-4	3-Methylthiophene	ND	20	ND	5.0	
110-01-0	Tetrahydrothiophene	ND	18	ND	5.0	
638-02-8	2,5-Dimethylthiophene	ND	23	ND	5.0	
872-55-9	2-Ethylthiophene	ND	23	ND	5.0	
110-81-6	Diethyl Disulfide	ND	12	ND	2.5	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

LABORATORY CONTROL SAMPLE SUMMARY

Page 1 of 1

Client: Aquaterra Environmental Solutions, Inc.
Client Sample ID: Lab Control Sample
Client Project ID: Cottonwood Hills Flare Gas Sample / 4733.12

CAS Project ID: P1300527
 CAS Sample ID: P130208-LCS

Test Code: ASTM D 5504-08
 Instrument ID: Agilent 7890A/GC22/SCD
 Analyst: Mike Conejo
 Sample Type: 1 L Zefon Bag
 Test Notes:

Date Collected: NA
 Date Received: NA
 Date Analyzed: 2/08/13
 Volume(s) Analyzed: NA ml(s)

CAS #	Compound	Spike Amount ppbV	Result ppbV	% Recovery	CAS	Data Qualifier
					Acceptance Limits	
7783-06-4	Hydrogen Sulfide	2,050	1,560	76	63-140	
463-58-1	Carbonyl Sulfide	2,020	1,400	69	63-138	
74-93-1	Methyl Mercaptan	1,890	1,370	72	63-144	



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www.alsglobal.com

LABORATORY REPORT

October 30, 2013

Tim Pool
SCS Aquaterra
13 Executive Dr., Suite 1
Fairview Heights, IL 62208

RE: Cottonwood Hills Flare Gas Sample

Dear Tim:

Enclosed are the results of the samples submitted to our laboratory on October 25, 2013. For your reference, these analyses have been assigned our service request number P1304751.

All analyses were performed according to our laboratory's NELAP and DoD-ELAP-approved quality assurance program. The test results meet requirements of the current NELAP and DoD-ELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP and DoD-ELAP-accredited analytes, refer to the certifications section at www.alsglobal.com. Results are intended to be considered in their entirety and apply only to the samples analyzed and reported herein.

If you have any questions, please call me at (805) 526-7161.

Respectfully submitted,

ALS | Environmental



By Sue Anderson at 11:27 am, Oct 30, 2013

Sue Anderson
Project Manager

RIGHT SOLUTIONS | RIGHT PARTNER



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Simi Valley, CA 93065
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www.alsglobal.com

Client: SCS Aquaterra
Project: Cottonwood Hills Flare Gas Sample

Service Request No: P1304751

CASE NARRATIVE

The samples were received intact under chain of custody on October 25, 2013 and were stored in accordance with the analytical method requirements. Please refer to the sample acceptance check form for additional information. The results reported herein are applicable only to the condition of the samples at the time of sample receipt.

Sulfur Analysis

The samples were analyzed for twenty sulfur compounds per ASTM D 5504-08 using a gas chromatograph equipped with a sulfur chemiluminescence detector (SCD). All compounds with the exception of hydrogen sulfide and carbonyl sulfide are quantitated against the initial calibration curve for methyl mercaptan. This method is not included on the laboratory's NELAP, DoD-ELAP, or AIHA-LAP scope of accreditation.

The results of analyses are given in the attached laboratory report. All results are intended to be considered in their entirety, and ALS Environmental (ALS) is not responsible for utilization of less than the complete report.

Use of ALS Environmental (ALS)'s Name. Client shall not use ALS's name or trademark in any marketing or reporting materials, press releases or in any other manner ("Materials") whatsoever and shall not attribute to ALS any test result, tolerance or specification derived from ALS's data ("Attribution") without ALS's prior written consent, which may be withheld by ALS for any reason in its sole discretion. To request ALS's consent, Client shall provide copies of the proposed Materials or Attribution and describe in writing Client's proposed use of such Materials or Attribution. If ALS has not provided written approval of the Materials or Attribution within ten (10) days of receipt from Client, Client's request to use ALS's name or trademark in any Materials or Attribution shall be deemed denied. ALS may, in its discretion, reasonably charge Client for its time in reviewing Materials or Attribution requests. Client acknowledges and agrees that the unauthorized use of ALS's name or trademark may cause ALS to incur irreparable harm for which the recovery of money damages will be inadequate. Accordingly, Client acknowledges and agrees that a violation shall justify preliminary injunctive relief. For questions contact the laboratory.



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ALS Environmental – Simi Valley

Certifications, Accreditations, and Registrations

Agency	Web Site	Number
AIHA	http://www.aihaaccreditedlabs.org	101661
Arizona DHS	http://www.azdhs.gov/lab/license/env.htm	AZ0694
DoD ELAP	http://www.pjilabs.com/search-accredited-labs	L11-203
Florida DOH (NELAP)	http://www.doh.state.fl.us/lab/EnvLabCert/WaterCert.htm	E871020
Maine DHHS	http://www.maine.gov/dhhs/mecdc/environmental-health/water/dwp-services/labcert/labcert.htm	2012039
Minnesota DOH (NELAP)	http://www.health.state.mn.us/accreditation	581572
New Jersey DEP (NELAP)	http://www.nj.gov/dep/oqa/	CA009
New York DOH (NELAP)	http://www.wadsworth.org/labcert/elap/elap.html	11221
Oregon PHD (NELAP)	http://public.health.oregon.gov/LaboratoryServices/EnvironmentalLaboratoryAccreditation/Pages/index.aspx	CA200007
Pennsylvania DEP	http://www.depweb.state.pa.us/labs	68-03307 (Registration)
Texas CEQ (NELAP)	http://www.tceq.texas.gov/field/qa/env_lab_accreditation.html	T104704413-13-4
Utah DOH (NELAP)	http://www.health.utah.gov/lab/labimp/certification/index.html	CA016272013-3
Washington DOE	http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html	C946

Analyses were performed according to our laboratory's NELAP and DoD-ELAP approved quality assurance program. A complete listing of specific NELAP and DoD-ELAP certified analytes can be found in the certifications section at www.alsglobal.com, or at the accreditation body's website.

Each of the certifications listed above have an explicit Scope of Accreditation that applies to specific matrices/methods/analytes; therefore, please contact the laboratory for information corresponding to a particular certification.

ALS ENVIRONMENTAL

DETAIL SUMMARY REPORT

Client: SCS Aquaterra
Project ID: Cottonwood Hills Flare Gas Sample

Service Request: P1304751

Date Received: 10/25/2013
Time Received: 07:55

ASTM D5504-01 - Sulfur Bag

Client Sample ID	Lab Code	Matrix	Date Collected	Time Collected	
CWH-7	P1304751-001	Air	10/24/2013	14:35	X
CWH-8	P1304751-002	Air	10/24/2013	14:45	X
CWH-9	P1304751-003	Air	10/24/2013	14:55	X



Page _____ of _____

Phone (805) 526-7161 Fax (805) 526-7270		Requested Turnaround Time In Business Days (Surcharges) please circle 1 Day (100%) 2 Day (75%) 3 Day (50%) 4 Day (35%) 5 Day (25%) 10 Day-Standard					CAS Project No. P1304751			
Company Name & Address (Reporting Information) Aquatera Environmental Solutions Inc. 13 Executive Drive Suite 1 Fairview Heights, IL 62208				Project Name Cottahwood Hills - Flare Gas Sample			CAS Contact:		Comments e.g. Actual Preservative or specific instructions	
							Analysis Method			
Project Manager Tim Pool				Project Number			ASTM D5504 total sulfur compounds			
Phone (618) 628-2001				P.O. # / Billing Information						
Fax (618) 628-2002				Sampler (Print & Sign) Jacob Allen <i>[Signature]</i>						
Email Address for Result Reporting tpool@aquatera-env.com				Canister ID (Bar code # - AC, SC, etc.)			Canister Start Pressure "Hg	Canister End Pressure "Hg/psig		Sample Volume
Client Sample ID		Laboratory ID Number	Date Collected	Time Collected	Flow Controller ID (Bar code # - FC #)					
CWH-7		①	10-24-13	1435	90675-60677	/	/	/		1L
CWH-8		②	↓	1445	90675-60675	/	/	/		1L
CWH-9		③	↓	1455	90675-60676	/	/	/		1L
Report Tier Levels - please select		Tier I (Results + QC & Calibration Summaries) _____					Tier II (Results + QC Summaries) _____		Project Requirements (MRLs, QAPP)	
Tier III (Results + QC & Calibration Summaries) _____		Tier IV (Data Validation Package) 10% Surcharge _____					EDD required Yes / No Type: _____			
Relinquished by: (Signature) <i>[Signature]</i>		Date: 10-24-13	Time: 1550	Received by: (Signature) <i>[Signature]</i>		Date: 10/24/13	Time: 0145	Cooler / Blank Temperature _____ °C		

WM00771

ALS Environmental Sample Acceptance Check Form

Client: SCS Aquaterra

Work order: P1304751

Project: Cottonwood Hills Flare Gas Sample

Sample(s) received on: 10/25/13

Date opened: 10/25/13

by: MZAMORA

Note: This form is used for all samples received by ALS. The use of this form for custody seals is strictly meant to indicate presence/absence and not as an indication of compliance or nonconformity. Thermal preservation and pH will only be evaluated either at the request of the client and/or as required by the method/SOP.

	Yes	No	N/A
1 Were sample containers properly marked with client sample ID?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2 Container(s) supplied by ALS ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3 Did sample containers arrive in good condition?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4 Were chain-of-custody papers used and filled out?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5 Did sample container labels and/or tags agree with custody papers?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6 Was sample volume received adequate for analysis?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7 Are samples within specified holding times?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8 Was proper temperature (thermal preservation) of cooler at receipt adhered to?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
9 Was a trip blank received?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
10 Were custody seals on outside of cooler/Box?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Location of seal(s)? _____ Sealing Lid?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were signature and date included?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were seals intact?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were custody seals on outside of sample container?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Location of seal(s)? _____ Sealing Lid?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were signature and date included?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were seals intact?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
11 Do containers have appropriate preservation , according to method/SOP or Client specified information?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Is there a client indication that the submitted samples are pH preserved?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were VOA vials checked for presence/absence of air bubbles?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Does the client/method/SOP require that the analyst check the sample pH and <u>if necessary</u> alter it?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
12 Tubes: Are the tubes capped and intact?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Do they contain moisture?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
13 Badges: Are the badges properly capped and intact?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Are dual bed badges separated and individually capped and intact?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Lab Sample ID	Container Description	Required pH *	Received pH	Adjusted pH	VOA Headspace (Presence/Absence)	Receipt / Preservation Comments
P1304751-001.01	1 L Zefon Bag					
P1304751-002.01	1 L Zefon Bag					
P1304751-003.01	1 L Zefon Bag					

Explain any discrepancies: (include lab sample ID numbers): _____

RSK - MEEPP, HCL (pH<2); RSK - CO2, (pH 5-8); Sulfur (pH>4)

ALS ENVIRONMENTAL

RESULTS OF ANALYSIS

Page 1 of 1

Client: SCS Aquaterra
Client Sample ID: CWH-7
Client Project ID: Cottonwood Hills Flare Gas Sample

ALS Project ID: P1304751
 ALS Sample ID: P1304751-001

Test Code: ASTM D 5504-08
 Instrument ID: Agilent 6890A/GC13/SCD
 Analyst: Mike Conejo
 Sample Type: 1 L Zefon Bag
 Test Notes:

Date Collected: 10/24/13
 Time Collected: 14:35
 Date Received: 10/25/13
 Date Analyzed: 10/25/13
 Time Analyzed: 09:44
 Volume(s) Analyzed: 0.050 ml(s)

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
7783-06-4	Hydrogen Sulfide	370,000	140	270,000	100	
463-58-1	Carbonyl Sulfide	2,800	250	1,100	100	
74-93-1	Methyl Mercaptan	8,900	200	4,500	100	
75-08-1	Ethyl Mercaptan	ND	250	ND	100	
75-18-3	Dimethyl Sulfide	16,000	250	6,300	100	
75-15-0	Carbon Disulfide	2,100	160	680	50	
75-33-2	Isopropyl Mercaptan	3,500	310	1,100	100	
75-66-1	tert-Butyl Mercaptan	840	370	230	100	
107-03-9	n-Propyl Mercaptan	ND	310	ND	100	
624-89-5	Ethyl Methyl Sulfide	ND	310	ND	100	
110-02-1	Thiophene	2,800	340	820	100	
513-44-0	Isobutyl Mercaptan	ND	370	ND	100	
352-93-2	Diethyl Sulfide	ND	370	ND	100	
109-79-5	n-Butyl Mercaptan	ND	370	ND	100	
624-92-0	Dimethyl Disulfide	ND	190	ND	50	
616-44-4	3-Methylthiophene	ND	400	ND	100	
110-01-0	Tetrahydrothiophene	ND	360	ND	100	
638-02-8	2,5-Dimethylthiophene	ND	460	ND	100	
872-55-9	2-Ethylthiophene	ND	460	ND	100	
110-81-6	Diethyl Disulfide	ND	250	ND	50	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

ALS ENVIRONMENTAL

RESULTS OF ANALYSIS

Page 1 of 1

Client: SCS Aquaterra
Client Sample ID: CWH-8
Client Project ID: Cottonwood Hills Flare Gas Sample

ALS Project ID: P1304751
 ALS Sample ID: P1304751-002

Test Code: ASTM D 5504-08
 Instrument ID: Agilent 6890A/GC13/SCD
 Analyst: Mike Conejo
 Sample Type: 1 L Zefon Bag
 Test Notes:

Date Collected: 10/24/13
 Time Collected: 14:45
 Date Received: 10/25/13
 Date Analyzed: 10/25/13
 Time Analyzed: 09:10
 Volume(s) Analyzed: 0.050 ml(s)

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
7783-06-4	Hydrogen Sulfide	520,000	140	380,000	100	
463-58-1	Carbonyl Sulfide	3,100	250	1,300	100	
74-93-1	Methyl Mercaptan	12,000	200	6,200	100	
75-08-1	Ethyl Mercaptan	ND	250	ND	100	
75-18-3	Dimethyl Sulfide	20,000	250	7,800	100	
75-15-0	Carbon Disulfide	2,400	160	770	50	
75-33-2	Isopropyl Mercaptan	4,800	310	1,500	100	
75-66-1	tert-Butyl Mercaptan	1,900	370	510	100	
107-03-9	n-Propyl Mercaptan	ND	310	ND	100	
624-89-5	Ethyl Methyl Sulfide	ND	310	ND	100	
110-02-1	Thiophene	3,600	340	1,000	100	
513-44-0	Isobutyl Mercaptan	ND	370	ND	100	
352-93-2	Diethyl Sulfide	ND	370	ND	100	
109-79-5	n-Butyl Mercaptan	ND	370	ND	100	
624-92-0	Dimethyl Disulfide	ND	190	ND	50	
616-44-4	3-Methylthiophene	ND	400	ND	100	
110-01-0	Tetrahydrothiophene	ND	360	ND	100	
638-02-8	2,5-Dimethylthiophene	ND	460	ND	100	
872-55-9	2-Ethylthiophene	ND	460	ND	100	
110-81-6	Diethyl Disulfide	ND	250	ND	50	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

ALS ENVIRONMENTAL

RESULTS OF ANALYSIS

Page 1 of 1

Client: SCS Aquaterra
Client Sample ID: CWH-9
Client Project ID: Cottonwood Hills Flare Gas Sample

ALS Project ID: P1304751
 ALS Sample ID: P1304751-003

Test Code: ASTM D 5504-08
 Instrument ID: Agilent 6890A/GC13/SCD
 Analyst: Mike Conejo
 Sample Type: 1 L Zefon Bag
 Test Notes:

Date Collected: 10/24/13
 Time Collected: 14:55
 Date Received: 10/25/13
 Date Analyzed: 10/25/13
 Time Analyzed: 09:28
 Volume(s) Analyzed: 0.050 ml(s)

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
7783-06-4	Hydrogen Sulfide	460,000	140	330,000	100	
463-58-1	Carbonyl Sulfide	2,800	250	1,100	100	
74-93-1	Methyl Mercaptan	11,000	200	5,500	100	
75-08-1	Ethyl Mercaptan	ND	250	ND	100	
75-18-3	Dimethyl Sulfide	18,000	250	7,000	100	
75-15-0	Carbon Disulfide	2,300	160	740	50	
75-33-2	Isopropyl Mercaptan	4,500	310	1,400	100	
75-66-1	tert-Butyl Mercaptan	2,500	370	690	100	
107-03-9	n-Propyl Mercaptan	ND	310	ND	100	
624-89-5	Ethyl Methyl Sulfide	ND	310	ND	100	
110-02-1	Thiophene	3,900	340	1,100	100	
513-44-0	Isobutyl Mercaptan	ND	370	ND	100	
352-93-2	Diethyl Sulfide	ND	370	ND	100	
109-79-5	n-Butyl Mercaptan	ND	370	ND	100	
624-92-0	Dimethyl Disulfide	ND	190	ND	50	
616-44-4	3-Methylthiophene	ND	400	ND	100	
110-01-0	Tetrahydrothiophene	ND	360	ND	100	
638-02-8	2,5-Dimethylthiophene	ND	460	ND	100	
872-55-9	2-Ethylthiophene	ND	460	ND	100	
110-81-6	Diethyl Disulfide	ND	250	ND	50	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

ALS ENVIRONMENTAL

RESULTS OF ANALYSIS

Page 1 of 1

Client: SCS Aquaterra
Client Sample ID: Method Blank
Client Project ID: Cottonwood Hills Flare Gas Sample

ALS Project ID: P1304751
 ALS Sample ID: P131025-MB

Test Code: ASTM D 5504-08
 Instrument ID: Agilent 6890A/GC13/SCD
 Analyst: Mike Conejo
 Sample Type: 1 L Zefon Bag
 Test Notes:

Date Collected: NA
 Time Collected: NA
 Date Received: NA
 Date Analyzed: 10/25/13
 Time Analyzed: 08:34
 Volume(s) Analyzed: 1.0 ml(s)

CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
7783-06-4	Hydrogen Sulfide	ND	7.0	ND	5.0	
463-58-1	Carbonyl Sulfide	ND	12	ND	5.0	
74-93-1	Methyl Mercaptan	ND	9.8	ND	5.0	
75-08-1	Ethyl Mercaptan	ND	13	ND	5.0	
75-18-3	Dimethyl Sulfide	ND	13	ND	5.0	
75-15-0	Carbon Disulfide	ND	7.8	ND	2.5	
75-33-2	Isopropyl Mercaptan	ND	16	ND	5.0	
75-66-1	tert-Butyl Mercaptan	ND	18	ND	5.0	
107-03-9	n-Propyl Mercaptan	ND	16	ND	5.0	
624-89-5	Ethyl Methyl Sulfide	ND	16	ND	5.0	
110-02-1	Thiophene	ND	17	ND	5.0	
513-44-0	Isobutyl Mercaptan	ND	18	ND	5.0	
352-93-2	Diethyl Sulfide	ND	18	ND	5.0	
109-79-5	n-Butyl Mercaptan	ND	18	ND	5.0	
624-92-0	Dimethyl Disulfide	ND	9.6	ND	2.5	
616-44-4	3-Methylthiophene	ND	20	ND	5.0	
110-01-0	Tetrahydrothiophene	ND	18	ND	5.0	
638-02-8	2,5-Dimethylthiophene	ND	23	ND	5.0	
872-55-9	2-Ethylthiophene	ND	23	ND	5.0	
110-81-6	Diethyl Disulfide	ND	12	ND	2.5	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

ALS ENVIRONMENTAL

LABORATORY CONTROL SAMPLE SUMMARY

Page 1 of 1

Client: SCS Aquaterra
Client Sample ID: Lab Control Sample
Client Project ID: Cottonwood Hills Flare Gas Sample

ALS Project ID: P1304751
ALS Sample ID: P131025-LCS

Test Code: ASTM D 5504-08
Instrument ID: Agilent 6890A/GC13/SCD
Analyst: Mike Conejo
Sample Type: 1 L Zefon Bag
Test Notes:

Date Collected: NA
Date Received: NA
Date Analyzed: 10/25/13
Volume(s) Analyzed: NA ml(s)

CAS #	Compound	Spike Amount ppbV	Result ppbV	% Recovery	ALS	Data Qualifier
					Acceptance Limits	
7783-06-4	Hydrogen Sulfide	2,050	1,350	66	63-140	
463-58-1	Carbonyl Sulfide	2,020	1,330	66	63-138	
74-93-1	Methyl Mercaptan	1,890	1,410	75	63-144	

APPENDIX C

CALCULATIONS

SCS AQUATERRA

LANDFILL GAS FLARE TESTING LOG

NET HEATING VALUE CALCULATIONS

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Input

Sample No.	CWH-4		
Date Collected	2/7/2013		
Percent Methane:		47.6	Percent
Net heat of combustion of methane*		802	KJ/g mole

Net Heating Value calculated using the following equation:

$$HT = K \sum C_i H_i$$

where:

H (T): Net Heating Value in (MJ/scm) at 25 deg. C, 760 mm Hg

K: 1.740×10^{-7} (1/ppm)(g mole/scm)(MJ/kcal)

where (g mole/scm) is at 20 deg. C

C_i : concentration of component sample component i in ppm

H_i : net heat of combustion for sample component i

in (kcal/g mole) at 25 deg. C, 760 mm Hg

Convert Heat of Combustion from Btu/scf to kcal/g mole

A) KJ/mol to J/mol

$$(802 \text{ kJ/g mole}) \times (1000 \text{ J/1 kJ}) = 802,000 \text{ J/g mole}$$

B) J/mole to cal/mole

$$(802,000 \text{ J/g mole}) \times (1 \text{ cal/4.184 J}) = 191,682.6 \text{ cal/g mole}$$

C) cal/mole to Kcal/mole

$$(191,682 \text{ cal/g mole}) \times (1 \text{ Kcal/1000 cal}) = 191.7 \text{ kcal/g mole}$$

Now calculate Net Heating Value

$$HT = K \sum C_i H_i$$

$$H(T) = 1.740 \times 10^{-7} (1/\text{ppm})(\text{g mole/scm})(\text{MJ/kcal}) \times 476000 \text{ ppm} \times 191.7 \text{ kcal/g-mole}$$

$$H(T) = 15.88 \text{ MJ/scm}$$

* Value from *Chemistry: The Central Science 2nd Edition*, by Theodore L. Brown and H. Eugene LeMay, Jr.

SCS AQUATERRA

LANDFILL GAS FLARE TESTING LOG

NET HEATING VALUE CALCULATIONS

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Input

Sample No.	CWH-5		
Date Collected	2/7/2013		
Percent Methane:		46.8	Percent
Net heat of combustion of methane*		802	KJ/g mole

Net Heating Value calculated using the following equation:

$$HT = K \sum C_i H_i$$

where:

H (T): Net Heating Value in (MJ/scm) at 25 deg. C, 760 mm Hg

K: 1.740×10^{-7} (1/ppm)(g mole/scm)(MJ/kcal)

where (g mole/scm) is at 20 deg. C

C_i : concentration of component sample component i in ppm

H_i : net heat of combustion for sample component i
in (kcal/g mole) at 25 deg. C, 760 mm Hg

Convert Heat of Combustion from Btu/scf to kcal/g mole

A) KJ/mol to J/mol	(802 kJ/g mole)*(1000 J/1 kJ) =	802,000 J/g mole
B) J/mole to cal/mole	(802,000 J/g mole)*(1 cal/4.184 J)=	191,682.6 cal/g mole
C) cal/mole to Kcal/mole	(191,682 cal/g mole)*(1 Kcal/1000 cal)=	191.7 kcal/g mole

Now calculate Net Heating Value

$$HT = K \sum C_i H_i$$

$$H(T) = 1.740 \times 10^{-7} (1/\text{ppm})(\text{g mole/scm})(\text{MJ/kcal}) \times 468000 \text{ ppm} \times 191.7 \text{ kcal/g-mole}$$

$$H(T) = 15.61 \text{ MJ/scm}$$

* Value from *Chemistry: The Central Science 2nd Edition*, by Theodore L. Brown and H. Eugene LeMay, Jr.

SCS AQUATERRA

LANDFILL GAS FLARE TESTING LOG

NET HEATING VALUE CALCULATIONS

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Input

Sample No.	CWH-6		
Date Collected	2/7/2013		
Percent Methane:		47.4	Percent
Net heat of combustion of methane*		802	KJ/g mole

Net Heating Value calculated using the following equation:

$$HT = K \sum C_i H_i$$

where:

H (T): Net Heating Value in (MJ/scm) at 25 deg. C, 760 mm Hg

K: 1.740×10^{-7} (1/ppm)(g mole/scm)(MJ/kcal)

where (g mole/scm) is at 20 deg. C

C_i : concentration of component sample component i in ppm

H_i : net heat of combustion for sample component i
in (kcal/g mole) at 25 deg. C, 760 mm Hg

Convert Heat of Combustion from Btu/scf to kcal/g mole

A) KJ/mol to J/mol

$$(802 \text{ kJ/g mole}) \times (1000 \text{ J/1 kJ}) = 802,000 \text{ J/g mole}$$

B) J/mole to cal/mole

$$(802,000 \text{ J/g mole}) \times (1 \text{ cal/4.184 J}) = 191,682.6 \text{ cal/g mole}$$

C) cal/mole to Kcal/mole

$$(191,682 \text{ cal/g mole}) \times (1 \text{ Kcal/1000 cal}) = 191.7 \text{ kcal/g mole}$$

Now calculate Net Heating Value

$$HT = K \sum C_i H_i$$

$$H(T) = 1.740 \times 10^{-7} (1/\text{ppm})(\text{g mole/scm})(\text{MJ/kcal}) \times 474000 \text{ ppm} \times 191.7 \text{ kcal/g-mole}$$

$$H(T) = 15.81 \text{ MJ/scm}$$

* Value from *Chemistry: The Central Science 2nd Edition*, by Theodore L. Brown and H. Eugene LeMay, Jr.

SCS AQUATERRA

LANDFILL GAS FLARE TESTING LOG

NET HEATING VALUE CALCULATIONS

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Input

Sample No.	CW4		
Date Collected:	9/26/2013		
Percent Methane:	53.4	Percent	
Net heat of combustion of methane*	802	KJ/g mole	

Net Heating Value calculated using the following equation:

$$HT = K \sum C_i H_i$$

where:

H (T): Net Heating Value in (MJ/scm) at 25 deg. C, 760 mm Hg

K: 1.740×10^{-7} (1/ppm)(g mole/scm)(MJ/kcal)

where (g mole/scm) is at 20 deg. C

C_i : concentration of component sample component i in ppm

H_i : net heat of combustion for sample component i
in (kcal/g mole) at 25 deg. C, 760 mm Hg

Convert Heat of Combustion from Btu/scf to kcal/g mole

A) KJ/mol to J/mol

$$(802 \text{ kJ/g mole}) \times (1000 \text{ J/1 kJ}) = 802,000 \text{ J/g mole}$$

B) J/mole to cal/mole

$$(802,000 \text{ J/g mole}) \times (1 \text{ cal/4.184 J}) = 191,682.6 \text{ cal/g mole}$$

C) cal/mole to Kcal/mole

$$(191,682 \text{ cal/g mole}) \times (1 \text{ Kcal/1000 cal}) = 191.7 \text{ kcal/g mole}$$

Now calculate Net Heating Value

$$HT = K \sum C_i H_i$$

$$H(T) = 1.740 \times 10^{-7} (1/\text{ppm})(\text{g mole/scm})(\text{MJ/kcal}) \times 534000 \text{ ppm} \times 191.7 \text{ kcal/g-mole}$$

$$H(T) = 17.81 \text{ MJ/scm}$$

* Value from *Chemistry: The Central Science 2nd Edition*, by Theodore L. Brown and H. Eugene LeMay, Jr.

SCS AQUATERRA

LANDFILL GAS FLARE TESTING LOG

NET HEATING VALUE CALCULATIONS

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Input

Sample No.	CW5		
Date Collected:	9/26/2013		
Percent Methane:	53.6	Percent	
Net heat of combustion of methane*	802	KJ/g mole	

Net Heating Value calculated using the following equation:

$$HT = K \sum CiHi$$

where:

H (T): Net Heating Value in (MJ/scm) at 25 deg. C, 760 mm Hg

K: 1.740×10^{-7} (1/ppm)(g mole/scm)(MJ/kcal)

where (g mole/scm) is at 20 deg. C

C_i : concentration of component sample component i in ppm

H_i : net heat of combustion for sample component i

in (kcal/g mole) at 25 deg. C, 760 mm Hg

Convert Heat of Combustion from Btu/scf to kcal/g mole

A) KJ/mol to J/mol

$$(802 \text{ kJ/g mole}) \times (1000 \text{ J/1 kJ}) = 802,000 \text{ J/g mole}$$

B) J/mole to cal/mole

$$(802,000 \text{ J/g mole}) \times (1 \text{ cal/4.184 J}) = 191,682.6 \text{ cal/g mole}$$

C) cal/mole to Kcal/mole

$$(191,682 \text{ cal/g mole}) \times (1 \text{ Kcal/1000 cal}) = 191.7 \text{ kcal/g mole}$$

Now calculate Net Heating Value

$$HT = K \sum CiHi$$

$$H(T) = 1.740 \times 10^{-7} (1/\text{ppm})(\text{g mole/scm})(\text{MJ/kcal}) \times 536000 \text{ ppm} \times 191.7 \text{ kcal/g-mole}$$

$$H(T) = 17.88 \text{ MJ/scm}$$

* Value from *Chemistry: The Central Science 2nd Edition*, by Theodore L. Brown and H. Eugene LeMay, Jr.

SCS AQUATERRA

LANDFILL GAS FLARE TESTING LOG

NET HEATING VALUE CALCULATIONS

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Input

Sample No.	CW6		
Date Collected:	9/26/2013		
Percent Methane:		53.8	Percent
Net heat of combustion of methane*		802	KJ/g mole

Net Heating Value calculated using the following equation:

$$HT = K \sum C_i H_i$$

where:

H (T): Net Heating Value in (MJ/scm) at 25 deg. C, 760 mm Hg

K: 1.740×10^{-7} (1/ppm)(g mole/scm)(MJ/kcal)

where (g mole/scm) is at 20 deg. C

C_i : concentration of component sample component i in ppm

H_i : net heat of combustion for sample component i
in (kcal/g mole) at 25 deg. C, 760 mm Hg

Convert Heat of Combustion from Btu/scf to kcal/g mole

A) KJ/mol to J/mol	(802 kJ/g mole)*(1000 J/1 kJ) =	802,000 J/g mole
B) J/mole to cal/mole	(802,000 J/g mole)*(1 cal/4.184 J)=	191,682.6 cal/g mole
C) cal/mole to Kcal/mole	(191,682 cal/g mole)*(1 Kcal/1000 cal)=	191.7 kcal/g mole

Now calculate Net Heating Value

$$HT = K \sum C_i H_i$$

$$H(T) = 1.740 \times 10^{-7} (1/\text{ppm})(\text{g mole/scm})(\text{MJ/kcal}) \times 538000 \text{ ppm} \times 191.7 \text{ kcal/g-mole}$$

$$H(T) = 17.95 \text{ MJ/scm}$$

* Value from *Chemistry: The Central Science 2nd Edition*, by Theodore L. Brown and H. Eugene LeMay, Jr.